the OIL AND GAS JOURNAL

JULY 14, 1958

Current Statistics p.189

Biggest-Inch Crude Line Proposed

Artery would link western Canada with Montreal p. 64

Foreign Rigs Busier as Drilling In U.S. and Canada Slumps p. 68

Geophysical Firms Face Dim Future

Skidding profits revealed by 13-firm study p. 72

Special Report

PIPELINE COMMUNICATION AND CONTROL p.89

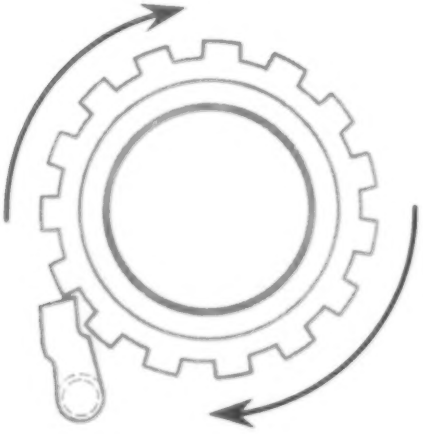
ONE DOLLAR PER COPY

Now for the first time in the Oil Field

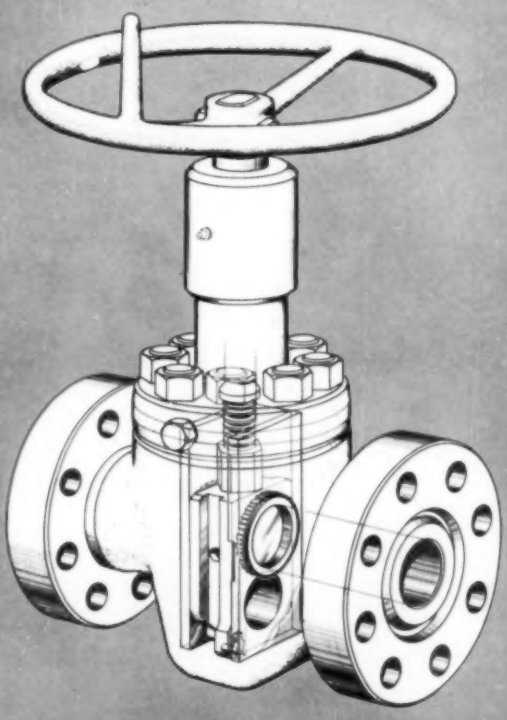
A valve for W. O. G. M.* *Service*

During a research program, Cameron engineers subjected every type of conventional valve to wear by opening and closing against high pressure abrasive flow. In the course of these tests it developed that the downstream seat on each valve showed the most wear, whereas other sealing surfaces in the valves were relatively undamaged.

Maximum wear always occurred at the same point on the seat. Then a new idea was conceived. Rotating the seat a fraction of a turn each time the valve was opened and closed would present a new surface at the point of greatest wear each time the valve was operated. This principle is the central feature of the new Cameron gate valve.



The same carefully controlled tests which produced such destructive wear on the conventional valves were re-run with the new Cameron gate valve. The remarkable results exceeded every expectation. Here for the first time is a valve with such unusual durability that it can perform any W.O.G.M.* service for many times the life span of any valve used in drilling and production service.



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**Water Oil Gas Mud*

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
July 14, 1958

Products prices have begun to move upward:

Gasoline prices on bulk cargo shipments increased by ¼-cent a gallon on the Texas Gulf Coast last week. This makes a total ¾-cent rise in last 3 weeks.

Mid-Continent refiners now are expected to move up their prices by at least ¼-cent this week.

The increase on the gulf covered all octane grades from 83 to 97. It put 90 octane at 10½ cents a gallon and 97 at 11⅞ with 99 unchanged at 12⅞ to 14 cents.

No. 2 fuel oil also is firming up, and refiners expect this burning oil to increase in price soon. They also predict further gasoline increases if demand continues good because products stocks have been cut down so sharply.

On crude pricing front: Sinclair has met Pure's 10-cent cut on sweet crude in Colorado, Nebraska, and Wyoming, and Texaco has put nearly all its postings on the 2-cent downward scale for higher gravities.

The price cuts in the Rockies now involve 60,000 bbl. of crude and make a general cut for the region almost sure. What effect they will have on competitive crudes from the Mid-Continent and North Texas is still uncertain.

These price developments may affect what the Texas Railroad Commission does this week on August allowables.

Other straws in the wind indicating producers will get 10 or 11 producing days instead of current 9:

...Commissioner Ernest O. Thompson says an increase is in line with market demand.

...Crude purchasers are saying they will ask for more production to meet rising refining needs. Reportedly favoring 10 days are Cities Service, Phillips, Shell, Atlantic Refining, and Gulf. For 11 days is Sun; and for 12 are Texaco, Humble, and Magnolia.

...Rumors that one buyer is moving a batch of Oklahoma crude into the Texas market to take up the slack.

Attitude of producers themselves may hold the key, however. Some independents want to use continued tight production as wedge to get more pipeline connections.

Better statistical forecasting of trends in the oil

industry is the ambitious goal of petroleum suppliers.

A research committee was handed the thorny problem at the 23rd annual PESA meeting in Quebec. Group hopes to devise a plan to gather, interpret, and distribute more accurate economic forecasts to guide management of its manufacturing, supply, and service company members.

The action spotlights a sore spot for all management: Nearly all economic forecasters show more accuracy predicting what will happen in a business upturn. Batting averages fall off in foretelling a downturn or charting its course.

Confidence in the basic soundness of the oil industry marked most committee and private sessions, which dealt primarily with ways of improving service. W. T. Powell of Continental-Emsco was elected president (p. 186).

Foreign rig activity is slowing down in rate of growth.

A Journal survey shows 851 rigs running in Free World outside the U. S. and Canada. That's 10 more than last year's record high of 841 but the 1957 total represented a jump of 60 rigs over 1956 activity.

Activity declines were recorded in South America, including Venezuela, the Middle East and Asia-Pacific areas. Gains were noted in Western Europe, Africa, and parts of North America (p.68).

Geophysical companies are uneasy at the outlook for their industry.

Current oil-exploration slump has merely accentuated a downward trend in geophysics which set in 5 years ago. Profits are down sharply. Some are losing money. None sees any hope soon of changing the trend.

Real hope is for geophysics to meet changes in exploration thinking. In past exploration has been geared to structure. Now accent is on geology and stratigraphy. If geophysicist can learn to map wedgeouts, porosity pinchouts, sand bars, and other elusive strat traps, demand for his services again will skyrocket.

Firms, meanwhile, are entering the foreign field, looking for opportunities in other fields, or making equipment to keep alive (p. 72).

Keep an eye on Berland River area of central west Alberta. Another major gas field is emerging there.

The Berland River A-8 wildcat of British American and Shell sliced through 663 feet of Leduc-Devonian D-3 reef from 12,014-12,677 ft. On tests, gas flows of 27,000 M.c.f. daily were posted.

Importance is this: It's thickest and the deepest productive reef yet found. In fact, oil explorers say it's the biggest strike in Canada this year. They think later drilling also may reveal an oil deposit which would add to its significance (p. 153).

Threat of low bridges over the intracoastal canal system has South Louisiana oil operators worried.

Louisiana Highway Department is asking U. S. Engineers to lower clearance requirements for future bridges over the waterways.

Move would cost oil industry millions annually by denying the canals to some big drilling barges or forcing others to dismantle before passing under a bridge (p. 81).

Alaska's potential oil lands may be opened to leasing before the end of the month.

Eisenhower's approval of the statehood bill paves the way. It permits leasing of lands beneath inland lakes and streams involving 10 million acres plus another 4 million acres in the Gubik area.

The law provides that federal leases in Alaska shall carry same rentals and royalties as those on public lands. It also removes the 5% discovery royalty provision and other former incentives for Alaskan development.

Exploration notes: Richfield's prolific San Emideo strike in California climaxes an amazing story of 20 years of seismic work, geological studies, and costly wildcatting by several companies (p. 66)...Mammoth multiwell drilling platforms are featuring new drilling activity in Gulf of Paria (p. 86)...Panama's first offshore well is below 6,000 ft. in Anita Bay off the north shore. Backers are Champlin, Kermac, and Southland Royalty (p. 88)...Phillips' two deep Texas holes are getting deeper. The 1-EE University is below 23,647 ft. in Simpson, and the 1-A Montgomery is at 22,954 ft. in the Ellenburger...Shell's 5 Rumberger, the Oklahoma depth king, is at 21,282 ft.

Good reports are coming from Humble's enriched-gas-drive recovery project in Seeligson field.

Injecting a 50-50 mixture of propane and separator gas, Humble has increased field pressure 300 psi. and brought down gas-oil ratios. Observation well 100 ft. from input well shows reservoir there has been swept almost completely clean of oil.

Humble has asked for reservoir allowable and more time to evaluate further the characteristics of the flood. If method proves as successful as indicated, it will mean a great lift for domestic production expectations (p. 70).

Carter has a new report on its 4-year-old LPG pilot flood in Oklahoma. It shows:

...Substantial quantities of oil can be produced at modest propane-oil and gas-oil ratios.

...Severe channeling does not occur when propane driven by gas is injected.

...Method is more effective than conventional secondary-

recovery processes in producing oil (p. 127).

Canadian independents have made strongest case for crude line from Alberta to the Montreal refining market.

They propose a $395-million, 2,019-mile, 36 and 34-in. line, claiming it could deliver Alberta crude to Montreal at $3.145 bbl. compared with $3.07 to $3.28 for Middle East and South American crudes now processed exclusively.

Attitude of Montreal refiners is key to the project, and at this stage they still are cool to the idea.

Automation in the form of complete centralized transport control is possible now in pipelining (p. 89).

But one authority in the field observes the speed with which any given company can adopt complete automation will depend largely on the number of men it trains to handle the new concepts and equipment.

He says key to automation is new skills, new equipment, and additional personnel.

An $81.5-million expansion is being planned by Trunkline Gas Co. to serve growing markets in Michigan.

Company's FPC filing reveals it plans 204-mile extension of its main system from Tuscola, Ill., to the Illinois-Michigan border, a 463-mile looping program, and more compressors.

Mark down El Paso Natural Gas Products Co. as a coming formidable refining and marketing competitor in the Southwest.

Company's ultramodern refinery at Odessa, Tex., goes on full operation this week with completion of new Platformer. Move puts it in forefront of any octane race which might come.

Just as important, El Paso has 248-mile, 6-in. products pipeline from Odessa to El Paso, has 284 service stations with plans to acquire more. All this from scratch in less than 3 years (p. 76).

Imports remain in the spotlight:

...Government won first court attack on legality of the voluntary control program.

...West Coast importers apparently are going along with small cutback to make room for eight newcomers.

...Senate finance committee has begun foreign trade study after hearing pleas for mandatory oil-import quotas.

Glowing prospects for shale oil are painted in report just made by University of Denver Research Institute.

It says crude shale oil can be delivered to West Coast at $1.42 to $1.92 per bbl., exclusive of profit. Production of as much as a million barrels daily from 1970 on is quite reasonable.

The economic study is based on work being done by the institute with the Aspeco process of retorting shale oil.

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Good Wells Make Good News

A Monthly Report of Successful Well Treatments

July 14, 1958

For over-all fracturing economy—including first cost, time of payout, rate of decline, and frequency of workovers—it will pay you to consider Dowell's fracturing services. Here are some recent studies of Dowell fracturing results:

- **Beaver County, Oklahoma.** (New Gas Well) Completed through perforations into the Hoover formation, 4420 to 4467 feet, this well came in natural with a potential of 4190 mcfd. The well was broken down and treated with 500 gallons Mud Acid, followed by 500 gallons Dowell acid with demulsifying and silicate control agents added. This increased potential production to 6360 mcfd. Then the well was fractured with Petrojel*, using 30,000 gallons of gelled crude with 80,000 pounds of sand plus F.L.A.* (Fluid Loss Additive). The average injection rate was 54.2 bpm. After treatment and clean-up, the well was given a four point test which showed an *open flow potential of 126 mmcfd.*

- **Christian County, Illinois.** (New Oil Well) This well was completed open hole in the Silurian dolomite from 1910 feet to 1921 feet. Since this was known to be a problem reservoir, the operator had formation samples tested. He found that the formation reacted twice as fast with intensified acid as it did with regular acid. Accordingly, he ordered Acid Petrofrac* with Dowell's intensifying agent added. 7000 gallons of acid-oil emulsion and 7000 pounds of sand were used. Freflo* in oil and 500 gallons Dowell Silicate Control Acid preceded the Acid Petrofrac. *After the well returned the load oil, the sustained production was 15 boph.*

- **Hot Springs County, Wyoming.** (Old Oil Well) This well was completed open hole, 3495 to 3562 feet, in the Phosphoria lime. This dense formation has some natural fractures and minor effective vugs. Before treatment, production had declined to 8 bopd. Operator ordered Acid Petrofrac, using 5000 gallons acid-oil emulsion and 5000 pounds sand. F.L.A. was added to the fracturing fluid to help extend the fractures and the drainage area of the well. Treatment was performed down tubing at 9 bpm. *45 days after treatment well was producing 70 bpd with two per cent water.*

- **Harrison County, East Texas.** (Old Oil Well) This well, completed through perforations into the Travis Peak sand, 6272 to 6276 feet, had declined to 25 bopd. Operator wanted to stimulate potential so he could get full allowable for eight-day production. Petrojel was selected, using 5000 gallons gelled crude with 5000 pounds sand. Injection was down tubing at 8 bpm. *After treatment settled production was 273 bopd.*

You have an intimate knowledge of *your* production problems and *your* well's characteristics. Likewise, your Dowell engineer knows what each of the many Dowell fracturing services is designed to do. He will work closely with you to help you get the most from a stimulation treatment. For service call any of the 165 Dowell service points and offices. In Canada, contact Dowell of Canada, Ltd.; in Venezuela, contact United Oilwell Service. Or write Dowell, Tulsa 1, Oklahoma.

*Dowell Trademark

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Pipeline Communication and Control Report

Complete Centralized Control Is Possible Today **89**
By George W. McGinley

A definite move to centralize systems control in pipelining has been started in recent years. And during the last 3 years, rigorous centralized control philosophies, including provisions for ultimate automation, have been proved repeatedly in service. Hardware for such systems is available today, even in packaged form.

Four Corners Pipe Line Operated by Remote Control **92**

The Four Corners Pipe Line is the first new long line designed for complete unattended operation. The main-line pump stations, pressure-reducing stations, delivery valve stations, booster pumps, and tank-filling and suction valves are designed for remote operation. Most of the feeder stations are equipped for automatic-custody-transfer operation.

Remote Control of Internal-Combustion-Engine Stations **97**
By P. R. Madden

The Topeka, Kans., station of Great Lakes Pipe Line Co. which utilizes an engine of the full-diesel type is controlled from El Dorado some 105 miles away. This station on the company's 10-in. products line from El Dorado to Kansas City is completely unattended. It matches the operating procedure of the motor-driven all-electric facilities.

Pipeline Communication Today and Tomorrow **103**
By C. L. Moon

The communication engineer is finding an increasing variety of tools to handle transmission of intracompany written records, routine messages, and actual pipeline operation for controlling pump units and data logging. Companies in general have their own private communication systems and supplement them with whatever common-carrier facilities are needed.

First Push Button Gas Pipeline Operating Successfully **114**
By Sy Orlofsky

After more than 5 years of planning and development, Gulf Interstate Gas Co.'s system of pipeline automation is now in service. The Stanton, Ky., station, an experimental satellite unit, was the prototype for the five fully automatic centrifugal-compressor stations.

TECHNOLOGY—OPERATION

Gas Chromatography—Powerful New Tool for Chemical Analysis—2 **122**
By H. H. Hausdorff and N. Brenner

A newly developed commercial instrument for chemical analysis is based on elution-partition chromatography. Its design, however, doesn't prohibit the use of adsorption columns.

Which Process Is Best for Flooding? **127**
By R. B. Chapman

Here are additional results on liquid propane injection into an oil reservoir, followed by gas drive.

Design of Mobile Drilling Unit "Louisiana" Based on Experience **129**
By J. L. Goldman

The designers of this new floating rig used the successes and failures of the past as guides when putting together plans for the unit.

Process Costimating **131**

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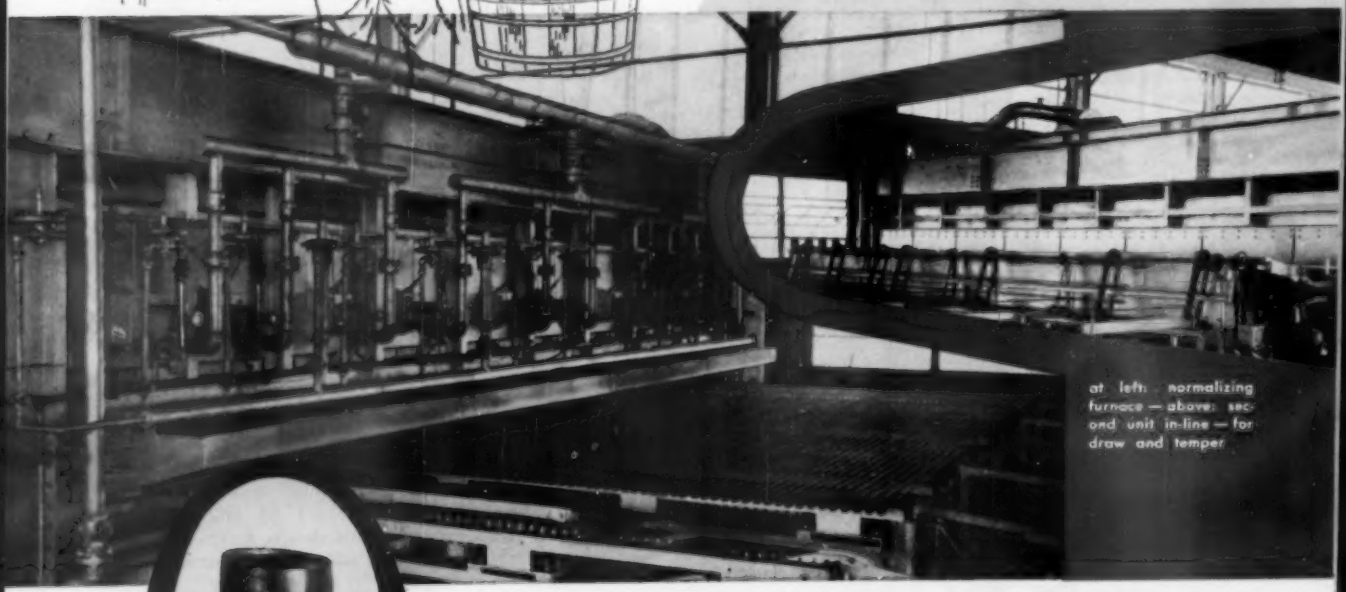
CHANGE IS INEVITABLE

—The Right Change Is Progress

The village blacksmith was considered an expert on heat-control . . . but his art would be lost here!



at left: normalizing furnace — above: second unit in-line — for draw and temper

Unretouched photograph of rod end before heat-treat. Note clean smooth forging by electric-induction process, unique with Norris.

. . . in LARGEST, MOST MODERN SUCKER ROD PLANT in the Oil Industry!

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- Rigidly exacting control of progression and time cycle in graduated heating and cool-out.

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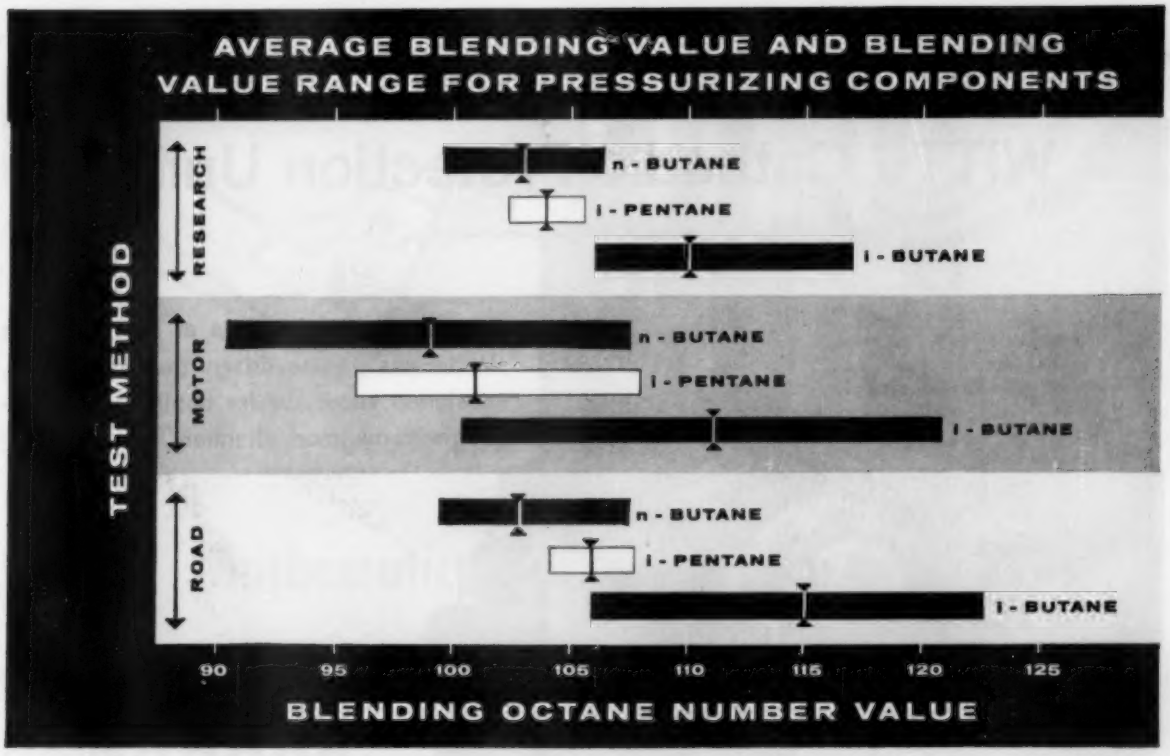

Average blending values are shown by the arrows. The length of the bar indicates the range of the blending values in the different base fuels.

Blending values of pressurizing agents in tomorrow's gasolines and engines

BY J. J. GREYTAK

The Du Pont Petroleum Laboratory has recently completed a significant road and laboratory study of the blending value of pressurizing agents. The results are particularly important because they were obtained with high octane stocks in high compression ratio cars.

The vapor pressure control materials studied in the tests were n-Butane, iso-Butane, and iso-Pentane.

Several typical fuels were made up from combinations of light and full-range cat-cracked stocks; C_5 and C_7 plus reformates; a thermally cracked reformate; an aromatic extract and an aviation quality alkylate.

The blends were treated with the three pressurizing agents and rated both in the laboratory and on the road. Road ratings were conducted in three 12:1 compression ratio cars. All finished blends contained 3 cc. of tetraethyl lead per gallon.

This table shows the average octane blending values of the three pressurizing agents:

OCTANE NUMBER	AVERAGE BLENDING VALUES		
	n-Butane	iso-Pentane	iso-Butane
Research ...	103	104	110
Motor	99	102	111
Road	103	106	115

Although i-Butane is shown to have the highest octane blending value of the three pressurizing agents, the amount that can be used in a commercial gasoline is limited by its high vapor pressure. Consideration of both volatility and octane blending values for the three vapor pressure control materials, leads to the conclusion that more gasolines of higher octane number can be made using i-Pentane than by using either of the butanes.

The exact quantities of iso-Pentane which should be employed will be determined by the amounts available as well as by the over-all refinery processing schemes.

In addition to the above, the investigations provided information on the influence of the base fuel compositions. For example, it was found that the Motor Method blending values of n-Butane and iso-Pentane were highest in fuels containing alkylate.

Further detailed information regarding this program is available upon request. E. I. du Pont de Nemours & Co. (Inc.), Petroleum Chemicals Division, Wilmington 98, Delaware.

JOHN J. GREYTAK is an engineer in the road antiknock group at the Du Pont Petroleum Laboratory. He is co-author of the paper "Road Octane Numbers of Tomorrow's Gasolines in Tomorrow's Cars" which he presented at the API Refinery Meeting in May 1957.

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4. Low water and oil level safety switches (optional at extra cost)
5. Oil make-up reservoir and float valve (optional at extra cost)
6. Fan bearing—grease-packed and sealed
7. Dual flywheels

GENERATOR—750 to 1800 rpm

1. V-belt driven
2. Direct current, shunt-wound, 3 KW
3. 32-40 volt
4. 94 amp. at 32 volts
5. Voltage control to less than 5 volts when generator speed is 750 rpm
6. Ammeter, voltmeter and circuit breaker
7. Splash-proof protection
8. Rodent protection
9. Grease-packed sealed bearing

. . . is built especially for cathodic protection of pipelines. The heavy-duty industrial-type gas engine has been thoroughly field-tested and is the ultimate in strength, simplicity and clean design. It has a low center of gravity, is well balanced, and every part is easily accessible. Built for 'round-the-clock operation, it has condenser cooling, removable wet cylinder liners and roller main bearings. It is equipped for long-run service, having oil make-up reservoir and float valve as well as lube oil and cooling water safety controls. Its wide speed range—500 rpm to 1200 rpm—provides a flexible voltage output.

USS and Witte are registered trademarks

Complete information on the **98RBD** *is available by contacting Witte Engine Works*

USS Witte Engines

gas-gasoline **models from 3¾ to 42 hp**
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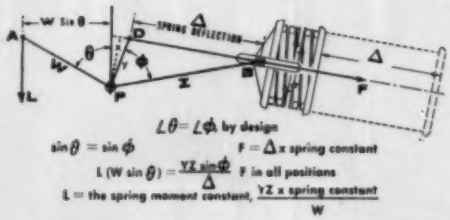


GRINNELL CONSTANT SUPPORT HANGERS may be adjusted over a 70% range of load carrying capacity, as indicated by the divisions on the load scale. When factory-adjusted to a specified load within this range, there always remains not less than 10% for additional field adjustment.

Compact design, resulting in small size for the load supported, makes Grinnell Constant Support Hangers easy to install—allows their use where only limited head room and space for close nesting are available. Simplicity of design makes these hangers easy to maintain.

Grinnell designs, manufactures and supplies pipe hangers and supports for every piping requirement.

In addition, Grinnell offers the services of trained field representatives and design services for consulting engineering firms. Contact Grinnell for your future hanger requirements.

Only Grinnell Hangers provide true constant support, plus these features:

- 5 frame sizes provide a range of travel from 1½ inches to 12 inches and support loads from 30 to 32,260 pounds.
- Load deflection curve is a horizontal straight line, at every setting on the load adjustment scale.
- Antifriction needle roller bearings are provided at all critical pivot points.
- Low ratio between spring force and supported load reduces friction, permits smaller size hangers for loads carried.
- Travel stop is a permanent attachment—always available for temporary use to set hanger into nonoperative position for underload or overload.

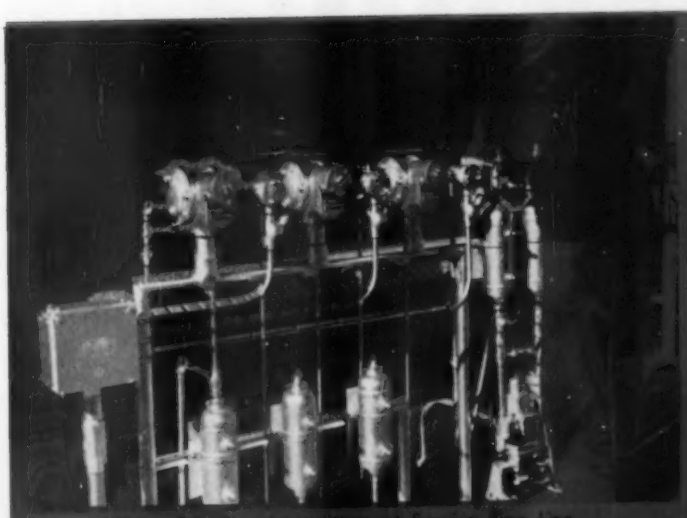
GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

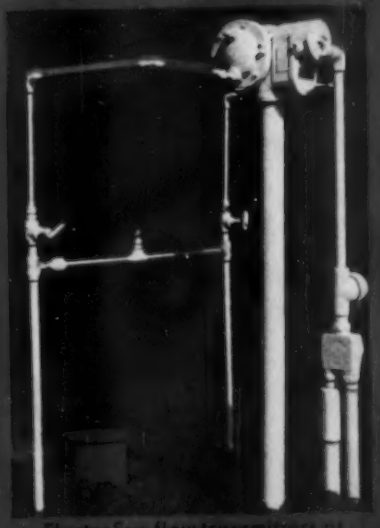
Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

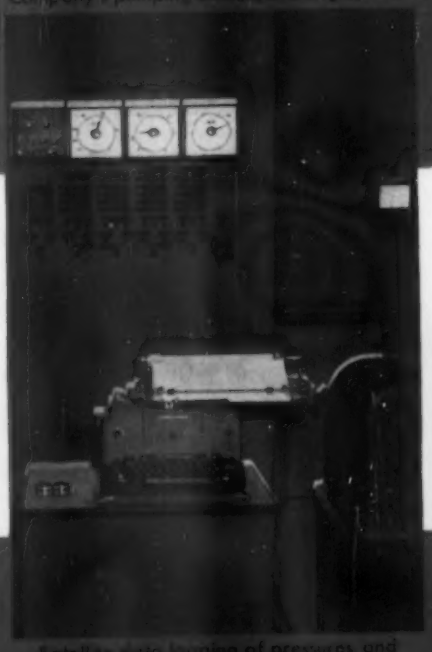
pressure and flow data



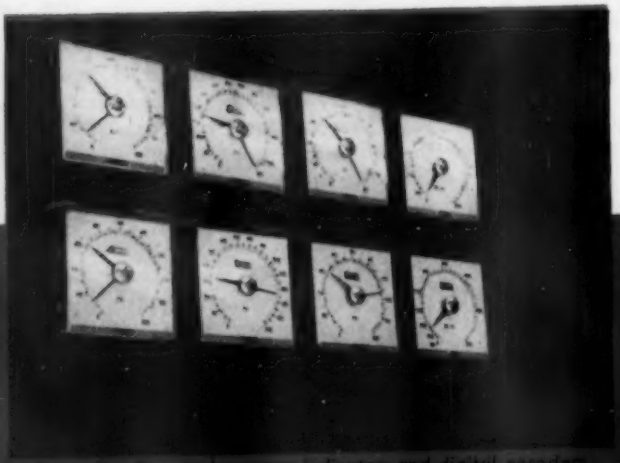
ElectroSyn flow transmitters at Service Pipe Line Company's pumping station, Drumright, Oklahoma.



ElectroSyn flow transmitters at Service Pipe Line's Blake Station [illegible]



Satellite data logging of pressures and flows at Drumright Station.



ElectroSyn flow and pressure indicators and digital encoders at Blake Station.

3 to 4 times more accurate with

NORWOOD CONTROLS **ELECTROSYN**

Norwood Controls' ElectroSyn digital telemetering transmitters are playing an important part in digital data handling for leading pipeline companies. The ElectroSyn System's digital approach automatically makes available — for logging — pressure and flow information with 3 to 4 times greater accuracy than can be attained by use of analog equipment. This increased accuracy results in considerably higher overall operating efficiency.

Digital pressure and flow values are transmitted in encoded form from pumping stations along the line to central logging points by data handling and checking equipment.

The ElectroSyn null-balance System consists of electro-magnetic transmitters and feedback units combined with magnetic amplifiers. Servo-indicators actuate adjustable high and low alarm contacts which are visible and can be set from the front of the instrument. Shaft positions of the servos are read out by encoders . . . linear encoders for pressure and square law encoders for flow. Additional encoders can be actuated to provide rate-of-change alarms.

More and more pipeline companies are choosing ElectroSyn Systems because they offer:

- Higher reliability
- Lower maintenance
- Flexibility of application
- Rugged electro-magnetic system
- Can withstand static overload of 200% of rated pressure with no zero shift
- Remote transmission
- Explosion-proof transmitters.

Write for ElectroSyn Bulletin B257 — Norwood Controls Unit, Detroit Controls Division, 942 Washington St., Norwood, Mass.

AMERICAN-Standard
DETROIT CONTROLS DIVISION

SPECIAL OIL WELL PROBLEMS REQUIRE HALLIBURTON'S SPECIAL CEMENTS AND ADDITIVES

Every oil well drilled has an individuality of its own. Two wells in the same field, drilled to the same depth, may require altogether different cementing techniques. In many cases, special well characteristics require special materials to help assure maximum cementing effectiveness and well protection.

Halliburton, the world's most experienced cementing organization, is *especially* qualified to help solve special oil well problems. Developed by laboratory research and field experience, Halliburton special cements and chemical additives have been proven to be effective wherever needed. Such problems as sulfate and salt water corrosion, high pressure gas and oil zones, elevated temperature of deeper wells ... these and others have been solved or minimized through the application of Halliburton's chemical aids.

It takes but a moment to call your nearby Halliburton representative. Protect the investment you have in your well with the best cementing available today... Halliburton, of course!

THESE...AND OTHER...HALLIBURTON CEMENTS AND CHEMICALS CAN HELP TO SOLVE THE SPECIAL PROBLEMS OF YOUR OIL WELLS:

POZMIX CEMENT... THE OUTSTANDING POZZOLANIC COMPOSITION

Pozmix Cement is a blend of pozzolanic materials and portland cement with desirable characteristics that cannot be obtained with neat portland slurries. It is resistant to sulfate and salt water corrosion. Pozmix Cement is also lower in cost, easier to pump, easier to perforate, less permeable and more durable. It has an outstanding record of proven performance in a wide variety of applications.

POZMIX 140... FOR HOT, DEEP WELLS

Designed for oil well cementing where formation temperatures range from 140° to 400° or higher, Pozmix 140 is a pozzolanic composition made up of Pozmix "A" or "S", hydrated lime and set control additives to give it early initial strength. It contains no portland type cement. At temperatures above 140°F, Pozmix 140 equals or exceeds strength specifications for oil well cements, yet is designed to provide a maximum pumpability in the deepest of wells. Results with Pozmix 140 have demonstrated its effectiveness in every case.

RADIO-ACTIVE CEMENT... NEWEST SCIENTIFIC AID

RAC-1 and RAC-2 are useful in locating cement tops, even in multi-stage jobs, locating the treated zone after squeeze cementing, locating split pipe. Half-life of material makes for safe, surer identification of cement, even after considerable delays following original job. No contamination to equipment or production. Also RAYFRAC Sand, for use in fracture location and differentiation.

HR-4... RETARDER

A small amount of HR-4 added to the mixing water or the dry cement at Halliburton bulk plants results in a composition with a retarded set, permitting placement at high temperatures. It is used with portland or Pozmix Cement in the deepest of wells.

HR-7... DISPERSANT AND RETARDER

Used mostly in wells of moderate temperature, HR-7 is a chemical dispersant and retarder designed for high gel cement compositions. HR-7 is effective in obtaining smoother and more fluid gel cement slurries.

HA-5... AN EFFECTIVE ACCELERATOR

An improved accelerator for oil well cementing slurries to be used for surface pipe or shallow wells. Higher compressive strengths at early ages are obtained, permitting W. O. C. times as short as four hours on surface pipe at temperatures of approximately 80°F.

MUD-KIL... AN EFFICIENT NEUTRALIZER

A dry, granular material that effectively neutralizes the cement-retarding properties of mud treating chemicals such as quebracho and other tannins, starch, sodium carboxymethyl cellulose and lignite. Pumping time and compressive strengths of cement remain relatively constant.

HI-DENSE... HELPS TO CONTROL HIGH PRESSURE ZONES

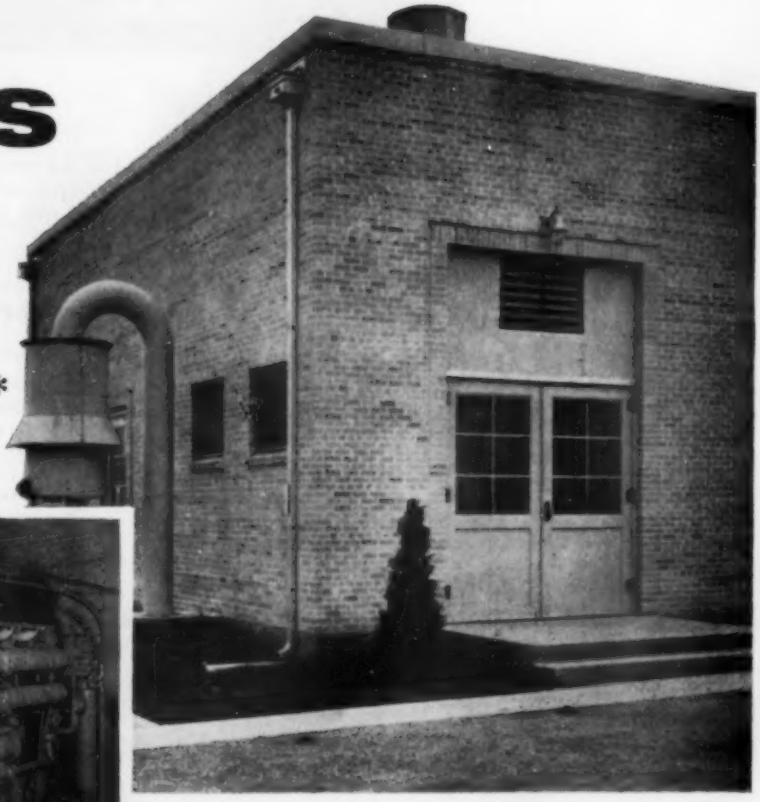
Ground to a fineness that requires a minimum amount of mixing water, Hi-Dense is designed to increase the density of cement slurry and aid in controlling high pressure gas and oil zones. Because of the high specific gravity of Hi-Dense, it is possible to weight cement slurries to 20 lbs./gal., yet still maintain pumpability and strength stability at high temperatures.

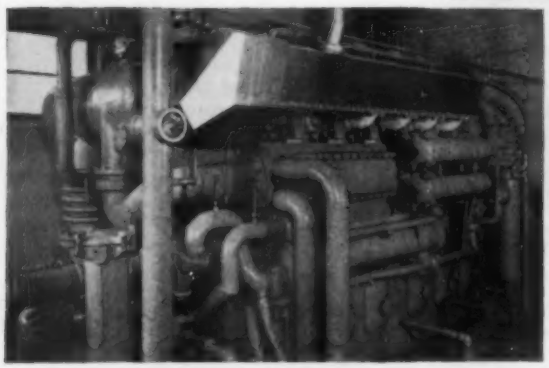
HALLIBURTON CEMENTING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

IN UNATTENDED AUTOMATIC STATIONS . . .

You can forget about dirty air when CYCOILS are on the job! . . . . . *





* An AAF Type W Cycoil protects the air intake for the 800 hp. Alco diesel engine at this unattended pumping station of Great Lakes Pipe Line Company near Topeka, Kansas.

Automatic pumping stations, which are completely unattended, are becoming more and more common in the petroleum industry. Here, too, AAF intake filters are on the job helping keep the wheels of automation in operation.

All equipment for these stations is selected on the basis of continuous, round-the-clock service, with an absolute minimum of maintenance. AAF Cycoil oil bath filters clean intake air—protect the valuable engines, which are the heart of the system.

Cycoils do their job with practically no maintenance. Every Cycoil is automatically self-cleaning—with no moving parts. The only maintenance necessary is the periodic removal of sludge from oil reservoir.

Whether your operation is automatic or not, you need this same type of positive protection. And—whatever your need in clean intake air, AAF has the right filter—engineered to save you maintenance dollars. Write today for bulletins, containing full information.

Type CMS Multi-Duty Filters

Type G Pipeline Air Filters

AAF

American Air Filter
COMPANY, INC.

444 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

— BETTER AIR IS OUR BUSINESS —

Type OCH Intake Air Filters

Cycoil Oil Bath Air Filters

Profit More ~~Barrels~~ Per $ Spent

With CABOT

You can make more oil for every dollar invested when CABOT pumping units are working for you!

CABOT builds a pumping unit that's specially designed for top production performance round-the-clock, month after month — unmatched when it comes to cost of operation — and, barrels of oil pumped.

Whether you specify the adjustable crank or beam-balanced series of CABOT pumping units, you'll soon see the increased values of production, durability and serviceability.

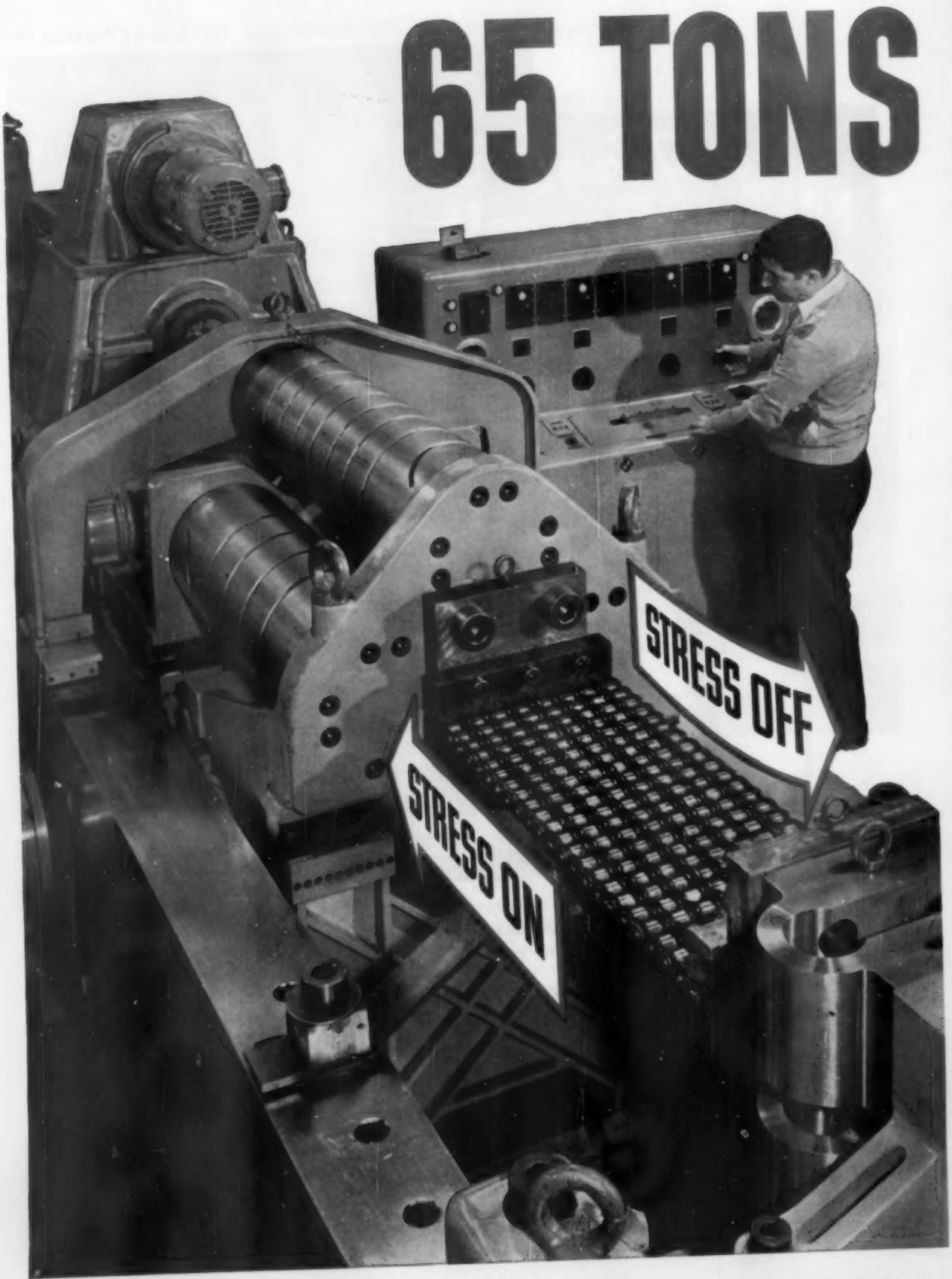
OIL FIELD PUMPING EQUIPMENT

CABOT SHOPS, INC.

PAMPA, TEXAS

FRANKS DIVISION OF CABOT

See your J & L Supply Man.


65 TONS
STRESS OFF
STRESS ON

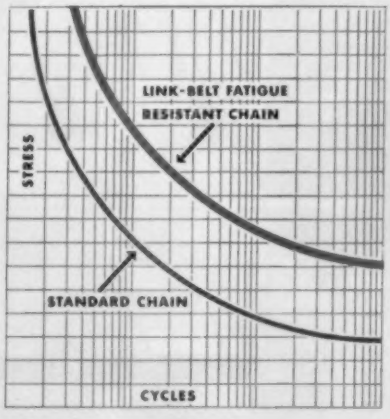
# of cyclic tension

Lab test proves the unexcelled fatigue strength of LINK-BELT roller chain with FR ®FATIGUE RESISTANT

The equipment you see here — largest of its type known to be in operation in roller chain testing — enables Link-Belt to test and rate the largest-pitch, multiple-width chains used on today's drilling rigs. Its rapid "stress-on, stress-off" action duplicates the toughest conditions of rig operation at a greatly accelerated pace. It proves conclusively (see chart) the superior *fatigue resistance* imparted to roller chain by the FR process.

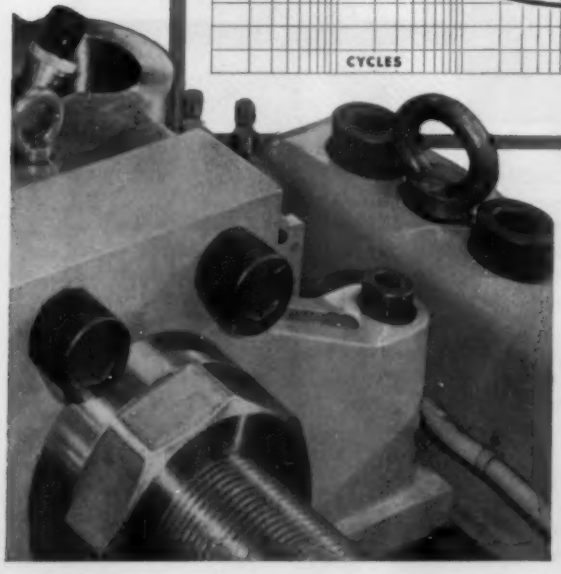
From such unequalled facilities for research comes roller chain unsurpassed in its ability to withstand the tremendous tensions of drilling service. In fact, Link-Belt can state without reservation: *No other roller chain has greater capacity to withstand the smashing impacts and tortuous stresses met in day-to-day drilling.*

FR and many other "extras" are standard with all Link-Belt oil field roller chains. Get full data in Catalog 2880, from any leading supply store.



U.S. Patent No. 2,517,497

This is FR. By compressing metal around pitch holes, Link-Belt greatly strengthens the critical sidebar areas most vulnerable to fatigue failure and greatly increases the chain's *dynamic strength.*



LINK-BELT

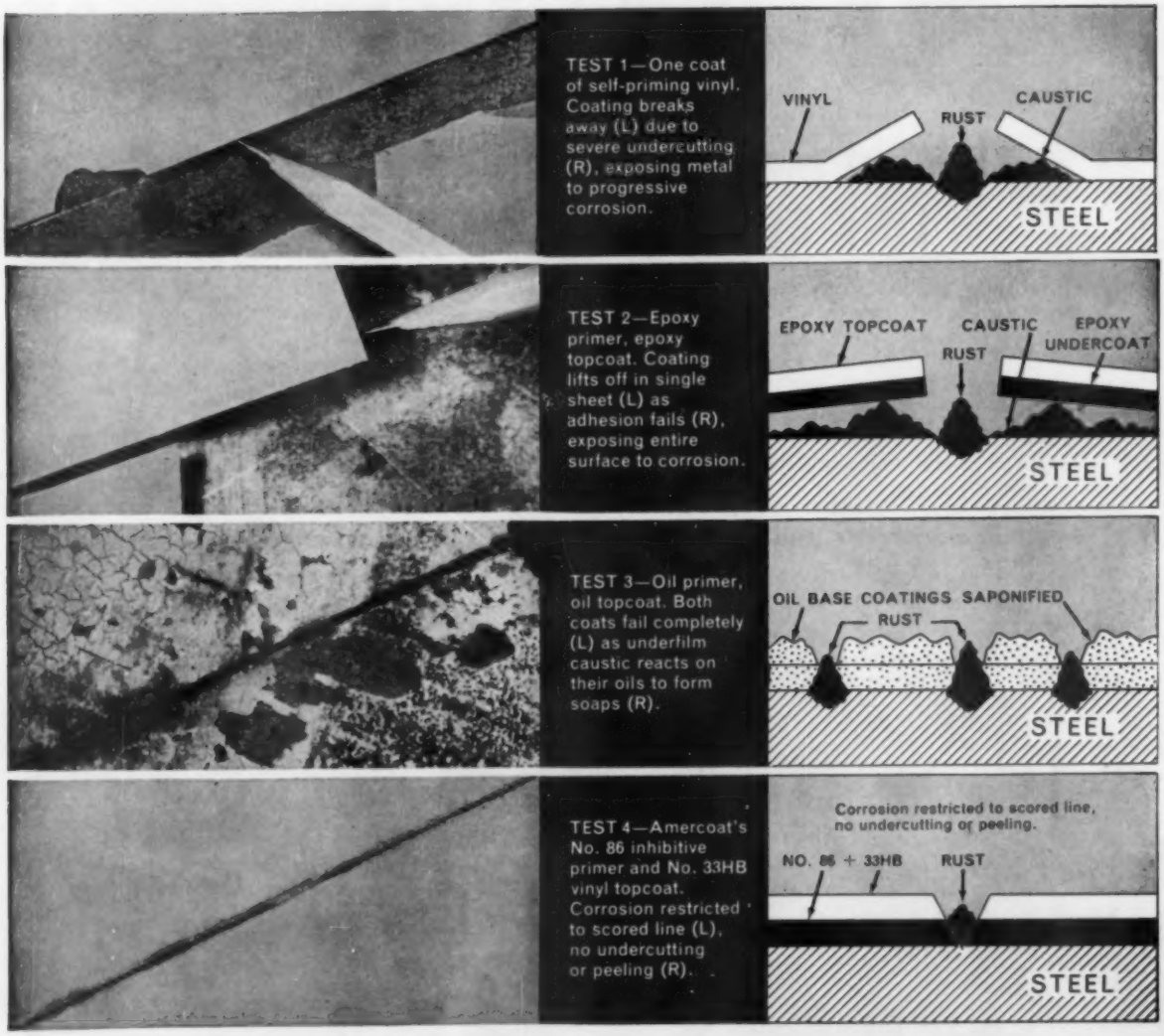
ROLLER CHAINS & SPROCKETS

14,803

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 26, Odessa, Tex., New Orleans 16, Shreveport La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields.

PUZZLED ABOUT PRIMERS?

Here are tests you can duplicate


TEST 1—One coat of self-priming vinyl. Coating breaks away (L) due to severe undercutting (R), exposing metal to progressive corrosion.
VINYL
RUST
CAUSTIC
STEEL
TEST 2—Epoxy primer, epoxy topcoat. Coating lifts off in single sheet (L) as adhesion fails (R), exposing entire surface to corrosion.
EPOXY TOPCOAT
CAUSTIC
RUST
EPOXY UNDERCOAT
STEEL
TEST 3—Oil primer, oil topcoat. Both coats fail completely (L) as underfilm caustic reacts on their oils to form soaps (R).
OIL BASE COATINGS SAPONIFIED
RUST
STEEL
TEST 4—Amercoat's No. 86 inhibitive primer and No. 33HB vinyl topcoat. Corrosion restricted to scored line (L), no undercutting or peeling (R).
Corrosion restricted to scored line, no undercutting or peeling.
NO. 86 + 33HB
RUST
STEEL

The purpose of these accelerated tests is to show what happens when various types of coatings are exposed to a typical corrosive environment. Four clean steel panels, free from mill scale and rust, were coated with different combinations of primers and topcoats. Each was scribed to bare metal and immersed in salt water in the presence of free oxygen, for two weeks.

As caustic deposits formed over cathodic areas of the steel in tests 1, 2 and 3, failure occurred in three ways. The vinyl, though not directly attacked, was undercut as caustic spread beneath the film and destroyed adhesion. The epoxy coating, known for critical adhesion to smooth metal, proved impervious to caustic attack. It was, however, lifted in its entirety as moisture spread beneath the surface. The entire oil paint film was quickly penetrated by the salt solution, creating widespread corrosion and caustic formation. The caustic then reacted with the oil to saponify the film.

In the fourth test the corrosion was limited to the score mark. Reason: Amercoat No. 86 Primer resists undercutting and adheres tenaciously, inhibiting electrolytic corrosive action.

The conclusions are clear. To provide long term protection in corrosive service, start with Amercoat No. 86 Primer, which provides a sound and lasting base for quality topcoats such as Amercoat No. 33HB.

Write today for complete data on Amercoat No. 86, and have the details on hand when planning your next important coating job.

Amercoat CORPORATION

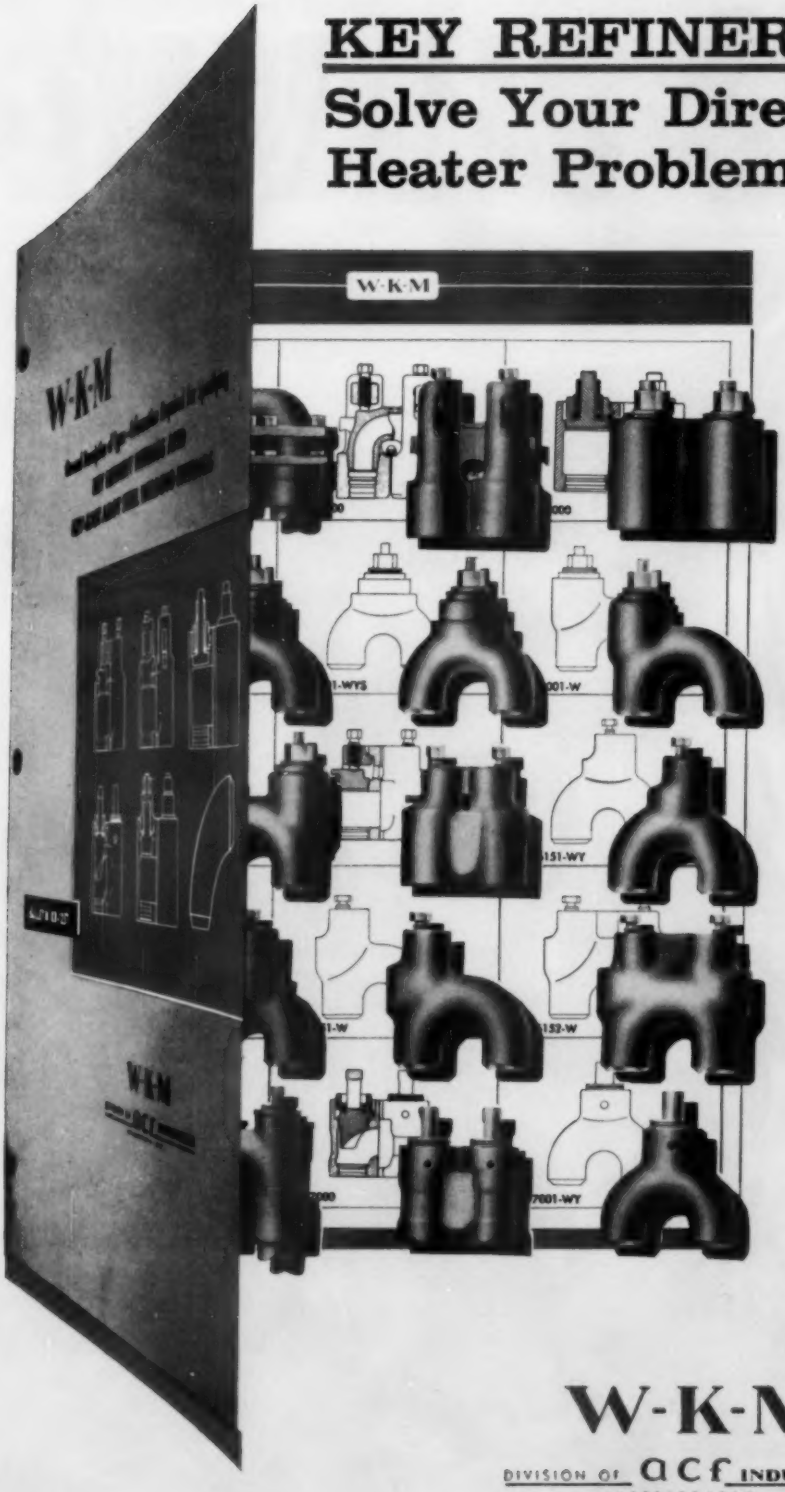
109A Dept. CG

4809 Firestone Blvd., South Gate, Calif.

W-K-M's

KEY REFINERY FITTINGS

Solve Your Direct-Fired Heater Problems



W-K-M's continuous research, broad experience and active participation in fitting design have been combined to anticipate your needs . . . W-K-M's engineers have solved most of your problems before they exist.

W-K-M's Bulletin KR-1257 details types of Key Refinery Fittings and gives information that will assist you in preparing a bill of materials for new construction, in ordering for inventory. Write for it . . . or call a Key Products engineer to go over your plans and assist you in outlining your requirements.

W-K-M's engineering and manufacturing assure longer life, lower costs for high-pressure, high-temperature piping systems.

W-K-M's Engineering in the field

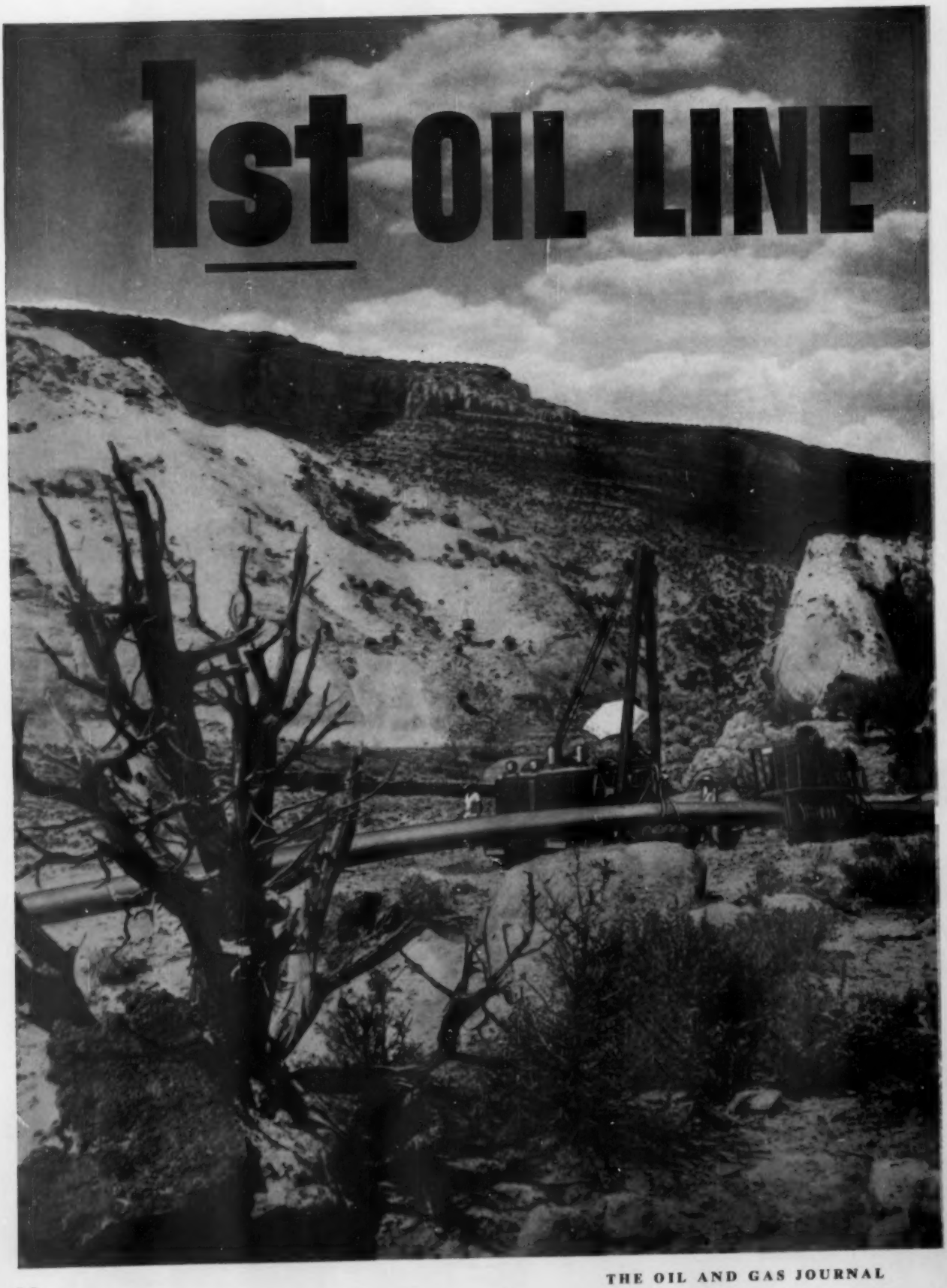
A highly trained Key Products field service engineer is at the other end of your telephone. His broad experience in the solution of fitting design problems for your direct-fired furnaces is yours for the asking.

W-K-M

DIVISION OF acf INDUSTRIES INCORPORATED

P. O. Box 2117, Houston, Texas

5802


1st OIL LINE

TO CALIFORNIA

The Four Corners Pipe Line is the first line ever built to supply California refineries with oil from outside the state

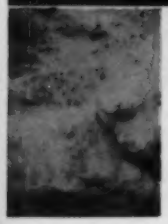
Shell Pipe Line Corporation, acting as agent for the Four Corners Pipe Line Company, designed, constructed and will operate this important 16-inch line. The line itself will be owned by six companies — Continental Pipe Line Company... Gulf Oil Corporation... Richfield Oil Corporation... Shell Oil Company... Standard Oil Company of California... and Superior Oil Company.

The purpose of the line is to tap reserves of 250 to 500 million bbls. to meet anticipated expansion in California's economy.

A. O. Smith furnished more than 600 of the 637 miles of 16-inch main line that runs from Aneth, Utah, to Los Angeles.

For almost 30 years... A. O. Smith line pipe has always been manufactured to a high standard of quality... precisely controlled at every step of production. That's why A. O. Smith pipe, made and installed in 1928, is still in operation. That's why so much A. O. Smith pipe is found in every important pipeline project.

From Aneth, Utah, to metropolitan Los Angeles, the line surmounts many obstacles. They include—elevations ranging from sea level to 6700 feet... deserts... three major river crossings... 200 miles of solid rock... and daily temperatures fluctuating between 40 and 120° F.



Through research ...*a better way*

A.O.Smith

CORPORATION

TUBULAR PRODUCTS DIVISION

Milwaukee 1, Wisconsin

Chicago 3 • Dallas 35 • Houston 2 • Los Angeles 17 • Tulsa 3
Midland 5, Texas • New Orleans 12 • New York 17
A. O. Smith International S. A., Milwaukee 1, Wisconsin, U. S. A.

Rayflo can save you as much as 8800 lbs. of thinner per rig . . . perhaps more!

You understand we can't reveal top secrets of the oil industry. But we can report that in one area where sloughing shale was a nasty problem, Rayflo saved an average of 8800 lbs. per rig . . . and there were 27 rigs working the field.

In problem drilling Rayflo really pays off. Not only sloughing shale, but at off-shore sites and in lime and gypsum muds too, Rayflo pays for itself wherever used. *Because it's the complete and economical replacement of other organic thinners!* Ask your mud service company for a demonstration!

For low-cost control of viscosity, gel strength and fluid loss, use TANFLO, a Rayflo blend.

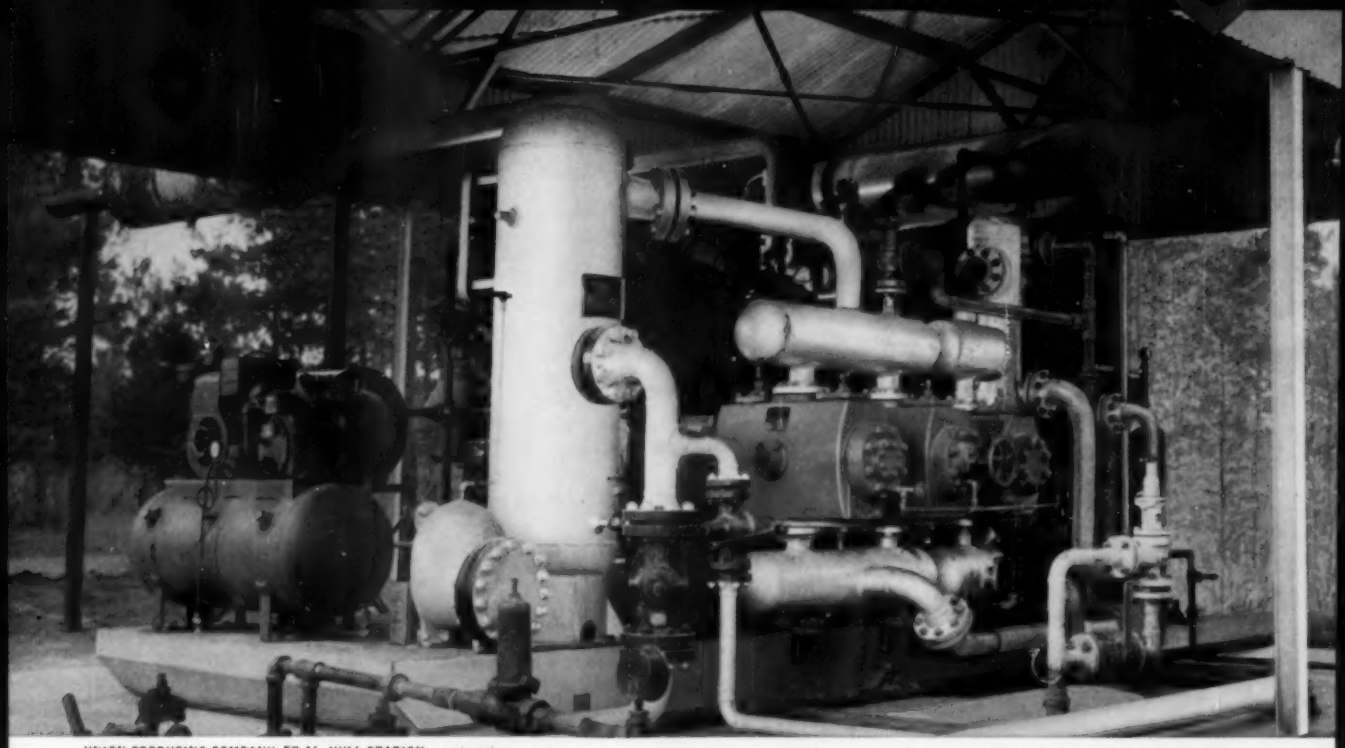
Sold through mud service companies, Tanflo is prepared under the same precision controls which have made Rayflo the accepted dispersant world-wide. Get the full Tanflo story. Check with your mud service company or write to: George E. Durkee, Technical Representative, Rayonier Incorporated, 161 East 42nd Street, New York 17. No obligation, of course!

RAYONIER

NATURAL RESOURCES CHEMISTRY
Rayonier Incorporated
Executive and General Sales Offices
161 East 42nd Street, New York 17, N. Y.

BEAIRD-INGERSOLL-RAND Packaged Compressor Plant

Lowest Cost Per Horsepower Installed



UNION PRODUCING COMPANY, ET AL. HULL STATION—equipped with a Beaird-Ingersoll-Rand 165 h.p. 6JVG Packaged Compressor. Unit has a Young Radiator with gas interstage, lubricating oil and engine cooling sections. Other Beaird compressors from 120 to 660 h.p.

Unit on Second Service—

FIELD CONVERSION FOR TWO STAGE OPERATION

Union Producing Company, et al., installed their Hull station in 1953 to boost gas in the Carthage Field. Consisting of one Beaird-Ingersoll-Rand 6JVG, 165-h.p. packaged compressor, the station handled 5.9 MMcfd with suction at 800 psig and discharge at 1300 psig.

During five years of production field pressures steadily declined until the original compressor could no longer operate efficiently. Rather than install a new unit it was determined that field conversion of the present compressor to two-stage operation would prove equally effective. This was quickly and economically done in the field. Two 7½-inch cylinders were placed on the first compression stage and a 5-inch cylinder on the second stage. Interstage gas cooling was provided by adding a gas coil at the front of the existing radiator. A scrubber for the second stage was installed and clearance bottle connections were provided on all cylinders.

The unit is now back in operation handling 2.5 MMcfd with suction at 100 psig and discharge at 300 psig. This field conversion will enable the unit to operate fully loaded down through final production of the field.

Beaird's gas engineers are experienced in finding economical solutions to every type of production problem . . . call us today.

THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana
A Subsidiary of American Machine & Foundry Company

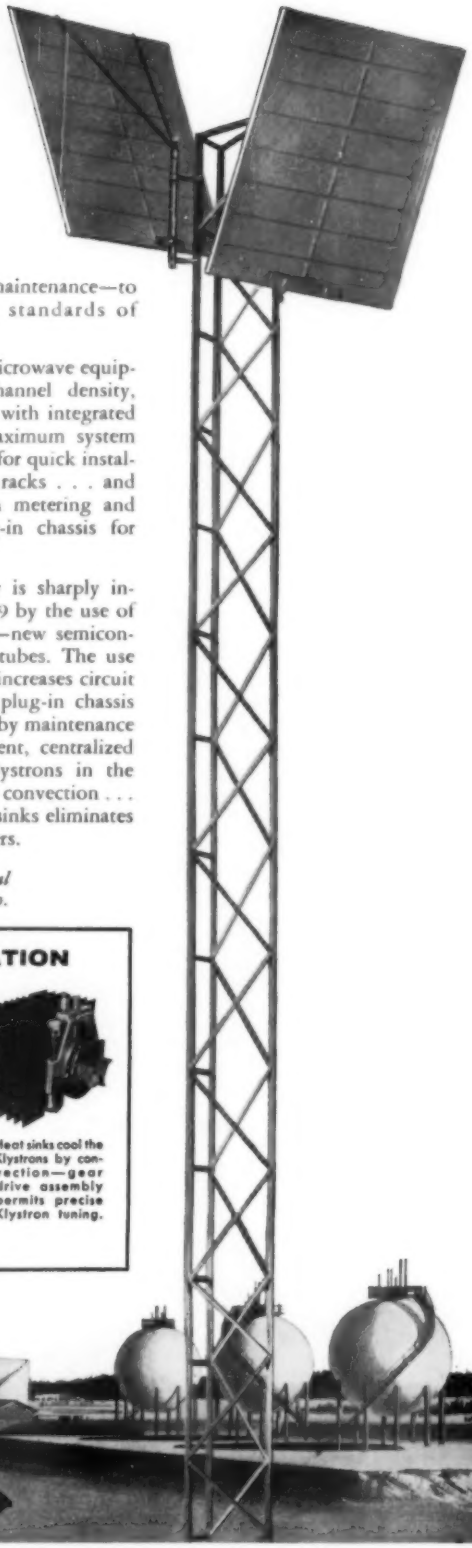
SHREVEPORT, LOUISIANA • *Sales Offices: Dallas, Houston, Corpus Christi and Midland, Texas • New Orleans, Louisiana • Tulsa, Oklahoma • Denver, Colorado • Los Angeles, California, and Cie. Ingersoll-Rand, Paris, France.*

BEAIRD INTERNATIONAL, INC. SHREVEPORT, LOUISIANA • *Sales Offices: Calgary, Alberta, Canada • Caracas, Venezuela.*

BEAIRD
another AMF product
PACKAGED COMPRESSOR PLANTS

Packaged Compressors are just one of the many products manufactured by Beaird for the petroleum and petrochemical industries. When you are in the market for new equipment or assistance in developing a specialized product . . . contact Beaird for a qualified appraisal or quotation.

Reliable, unattended microwave operation for pipeline communications and control!



PLUS PHILCO'S TURNKEY SERVICES

Philco CLR-9 microwave delivers outstanding system reliability, economy of installation and operation, simplified equipment maintenance for dependable pipeline communications. With 240 voice channel baseband capacity—for telephone, telemetering and remote control—and capability for handling high-speed computer data transmission—Philco microwave fills both immediate and long-range requirements of modern pipeliners.

Philco's complete turnkey service includes—*site surveys* by competent survey engineers experienced in field techniques; *system planning* by Philco's systems engineers who design your complete communications system; *installation* of your microwave system by Philco field engineers—including erection of towers and shelters; and, Philco field engineers are available for *field service*—periodic inspection and preventive maintenance—to maintain the highest standards of system performance.

Philco's new CLR-9 microwave equipment provides high channel density, duplex communications with integrated standby facilities for maximum system reliability. It is designed for quick installation in standard relay racks . . . and engineered with built-in metering and test facilities plus plug-in chassis for easy field maintenance.

Performance reliability is sharply increased in the new CLR-9 by the use of tubeless power supplies—new semiconductor rectifiers replace tubes. The use of printed wiring panels increases circuit stability—and complete plug-in chassis may be quickly removed by maintenance personnel (permits efficient, centralized depot maintenance). Klystrons in the new CLR-9 are cooled by convection . . . the use of compact heat sinks eliminates the need for bulky blowers.

At Philco, opportunities are unlimited in electronic and mechanical research and engineering • Look ahead . . . and you'll choose Philco.

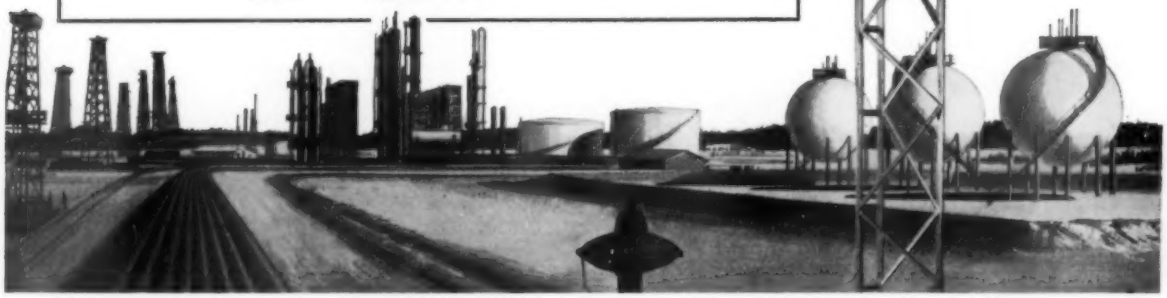
NEW PHILCO CLR-9 MICROWAVE STATION

The CLR-9 terminal consists of wave-guide assemblies, master control, tubeless power supplies and plug-in chassis for IF assembly, baseband drop, modulator, reflector control and servo.

Rugged printed wiring panels increase circuit stability and simplify maintenance.

Heavy-duty, tubeless power supplies increase reliability by employing semiconductor rectifiers—assures maximum reliability and minimum maintenance.

Heat sinks cool the Klystrons by convection—gear drive assembly permits precise Klystron tuning.



PHILCO

Government & Industrial Division

4716 Wissahickon Ave., Philadelphia 44, Pa.

In Canada: Philco Corporation of Canada Limited, Don Mills, Ontario

Three Rust-Oleum DIFFERENCES that save you time, money and metal!

GOES ON FASTER

No tedious surface preparations usually required — just scrape and wirebrush to remove rust scale and loose rust — then brush Rust-Oleum 769 Damp-Proof Red Primer right over the remaining rust.

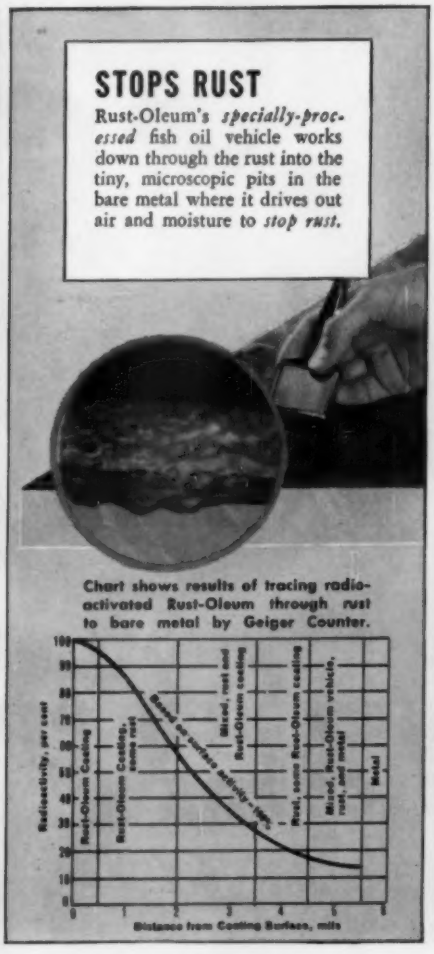


Chart shows results of tracing radio-activated Rust-Oleum through rust to bare metal by Geiger Counter.
Radioactivity, per cent
Distance from Coating Surface, mils
Rust-Oleum Coating
Rust-Oleum Coating, some rust
Mixed, rust and Rust-Oleum coating
Rust, some Rust-Oleum coating
Mixed, Rust-Oleum vehicle, rust, and metal
Metal

STOPS RUST

Rust-Oleum's *specially-processed* fish oil vehicle works down through the rust into the tiny, microscopic pits in the bare metal where it drives out air and moisture to *stop rust.*

LASTS LONGER

Applied over rust, Rust-Oleum lasts longer for the *over-the-years protection* you need. It resists sun, salt water, salt air, fumes, heat, humidity, moisture, weathering.

These are just a few of many important *differences* that separate Rust-Oleum from ordinary coatings. When you consider that Rust-Oleum covers approximately *30% more area,* depending upon surface condition and porosity . . . and the fact that Rust-Oleum finish coatings, with the same fish oil vehicle, are available in nearly every color for *double protection* . . . it's just good, common sense to use Rust-Oleum. Prompt delivery from Industrial Distributor stocks. Write for illustrated literature with color charts.

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THEY STANDARDIZE ON GASOS

Fig. 3671 — 2½" to 3½" x 6 Triplex Plunger Pump. Capacities of 191 to 375 barrels per hour at working pressures from 1575 to 800 PSI.

Pipe line engineers are practical men. They base their decisions on facts, not impressions . . . and it's facts that have led so many of them to adopt GASO Pumps as standard in their capacity range. *Recorded* facts which show that GASOS consistently outperform and outlast ordinary pumps, and therefore deliver more value per dollar. Ask for latest catalog.

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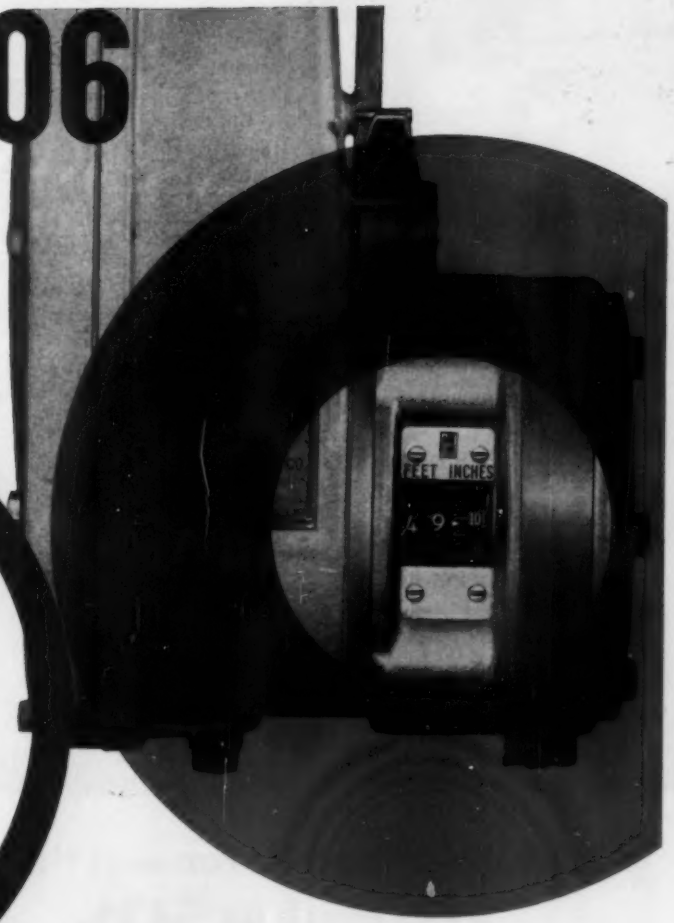

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Cut disconnect-reconnect time by as much as 50%

The FALK Spacer Coupling is specially designed for quick installation or removal *without disturbing the driving or driven unit.* This feature can save you up to 50% in disconnect-reconnect time when critical equipment—a process pump, for example—needs repair or replacement.

Here's another saving: with the FALK Spacer Coupling, you can quickly realign shafts *without the usual loss of operating temperature!*

And still another: you can remove or reinstall the FALK Spacer as a unit *without draining the lubricant.*

Because of its exclusive grid-groove Steelflex design, the FALK Spacer can accommodate residual misalignment—parallel, angular, or (most important) *both.* Also, it provides torsional resiliency that cushions shock and vibration. Thus it saves wear-and-tear on your connected equipment.

To prove these claims and enjoy these savings, install a FALK Spacer on one application—and see for yourself. Consult your FALK Representative or Authorized Distributor.

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MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS
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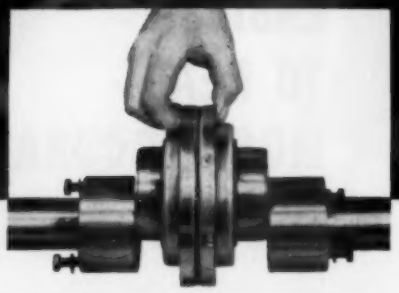
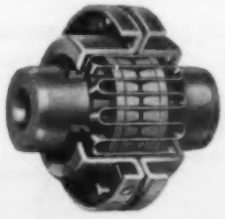


EASY AND QUICK TO INSTALL, DISCONNECT OR RECONNECT

First, mount shaft hubs to allow proper distance between hubs; then, align driving and driven units.

Second, compress Spacer to fit space between hubs and tighten cap screws to pull spacer hubs into the registered fit.

To disconnect, reverse the second step. No draining of lubricant necessary.



The heart of the FALK Spacer ...the basic Type F Steelflex
Write for Service Manual 4838

FALK
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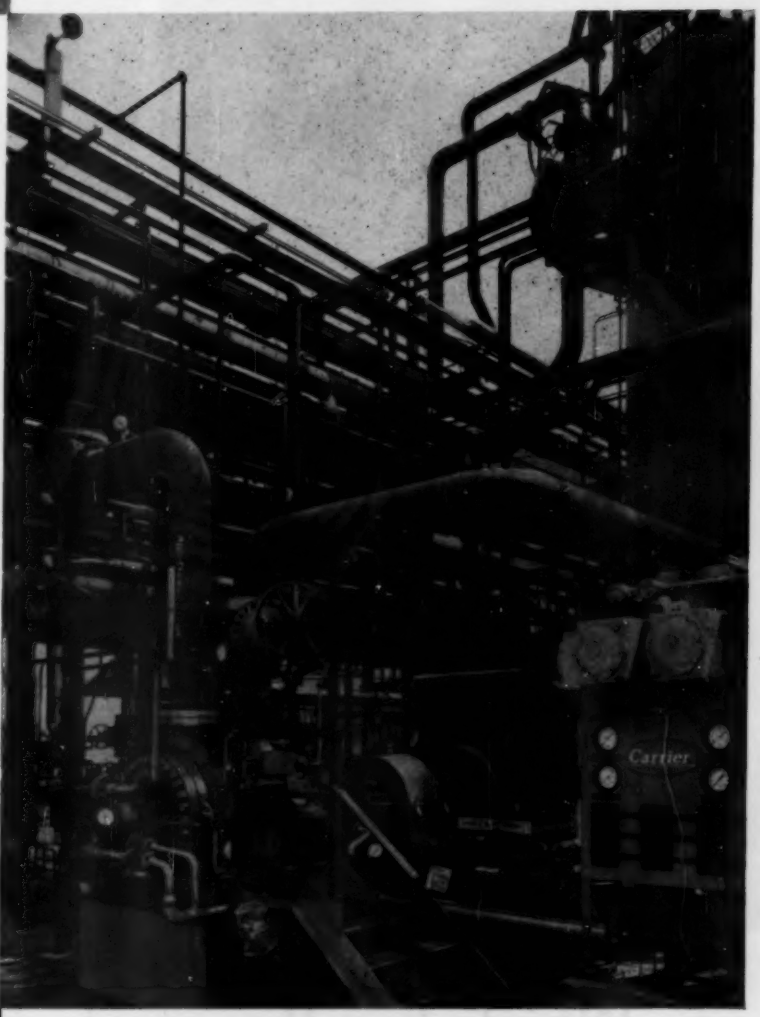
FARREL SPEED INCREASER

used in blower drive at Socony Mobil refinery



In service at the East St. Louis refinery of Socony Mobil Oil Company, Inc., the Farrel speed increaser pictured here is rated at 2875 HP. Designed to transmit power from an electric motor to a Carrier centrifugal compressor, this unit features several construction refinements that assure long, trouble-free service.

Gears are continuous-tooth herringbone, precision-generated by the Farrel-Sykes process. Both gears and pinions were completely finish-machined on their shafts to insure concentricity of pitch diameters with axes of rotation. Teeth were lapped to provide the smooth working surface so essential in high-speed operation.

The rugged gear case preserves original alignment of working parts. Oversize shafts guard against torsional deflections under peak torque variations. The high-speed shaft is a heat-treated, alloy-steel forging; the low-speed shaft is a forging of heat-treated carbon steel.

Farrel high-speed gear units are made in fifty-two sizes with speed ratios ranging from 1:1 to 40:1. They are described fully in *new* 28-page bulletin 451. Send for a copy today.

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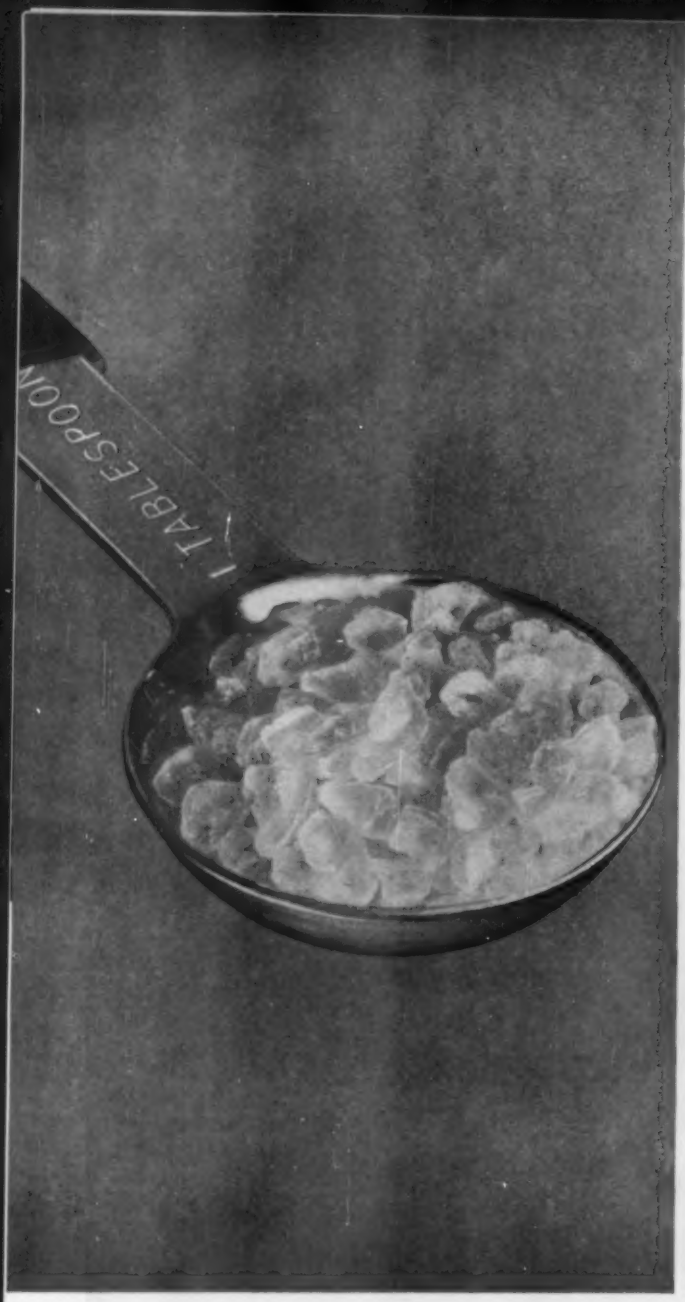
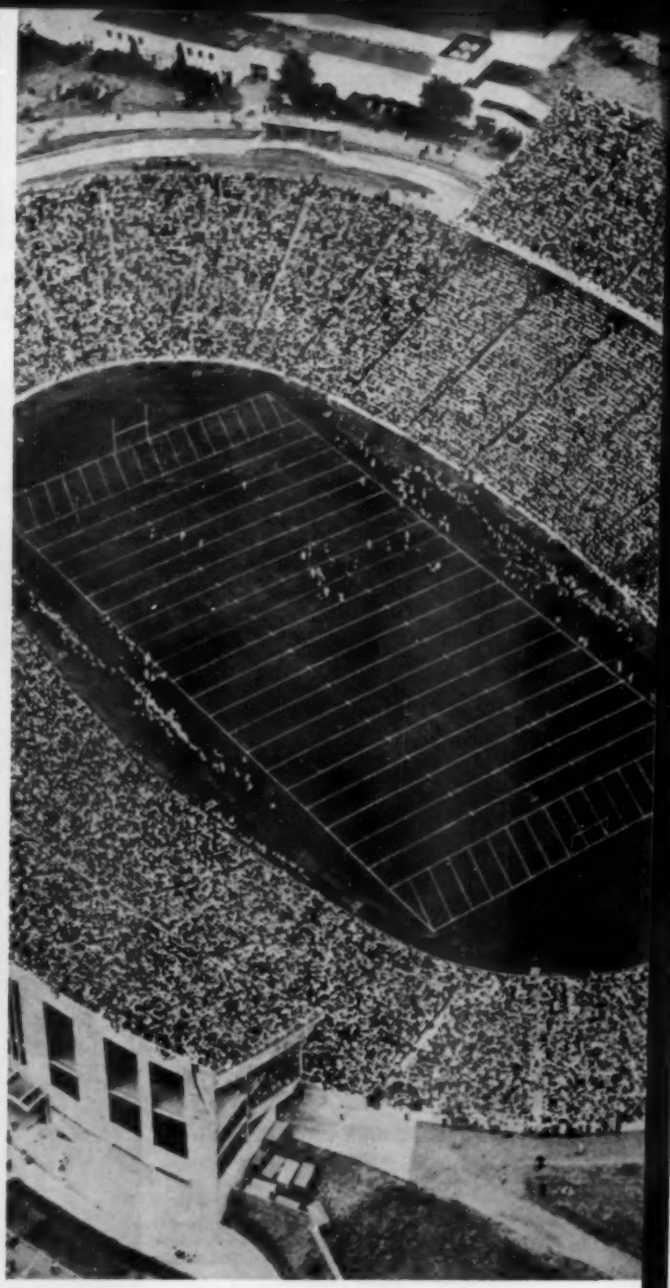
ABOVE: View at Socony Mobil refinery showing Farrel SI-18 high-speed gear unit at work.

LEFT: Rigid housing of the Farrel unit can be seen in this close-up.

Farrel-Birmingham®

FB-1146





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Davison Silica Gel adsorbs about 45% of its weight of water from saturated air. What makes it so vapor "thirsty"? One, its enormous internal surface. Two, its millions of tiny pores or capillaries. These *attract* vapors, *condense* them, *hold* them as liquids.

That's why you'll find Davison Silica Gel so efficient in drying air and gas. A variety of particle sizes, densities and adsorptive capacities are available. Each has been developed to meet specific application demands. There is one to suit yours.

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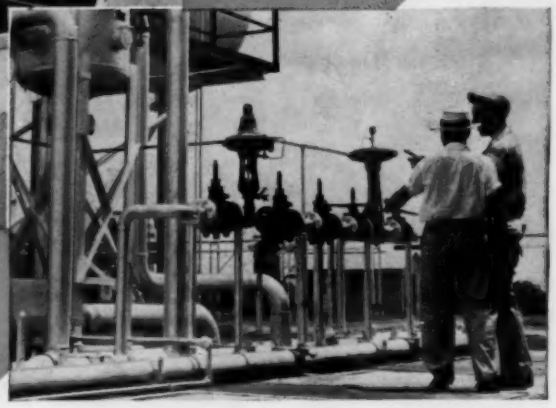

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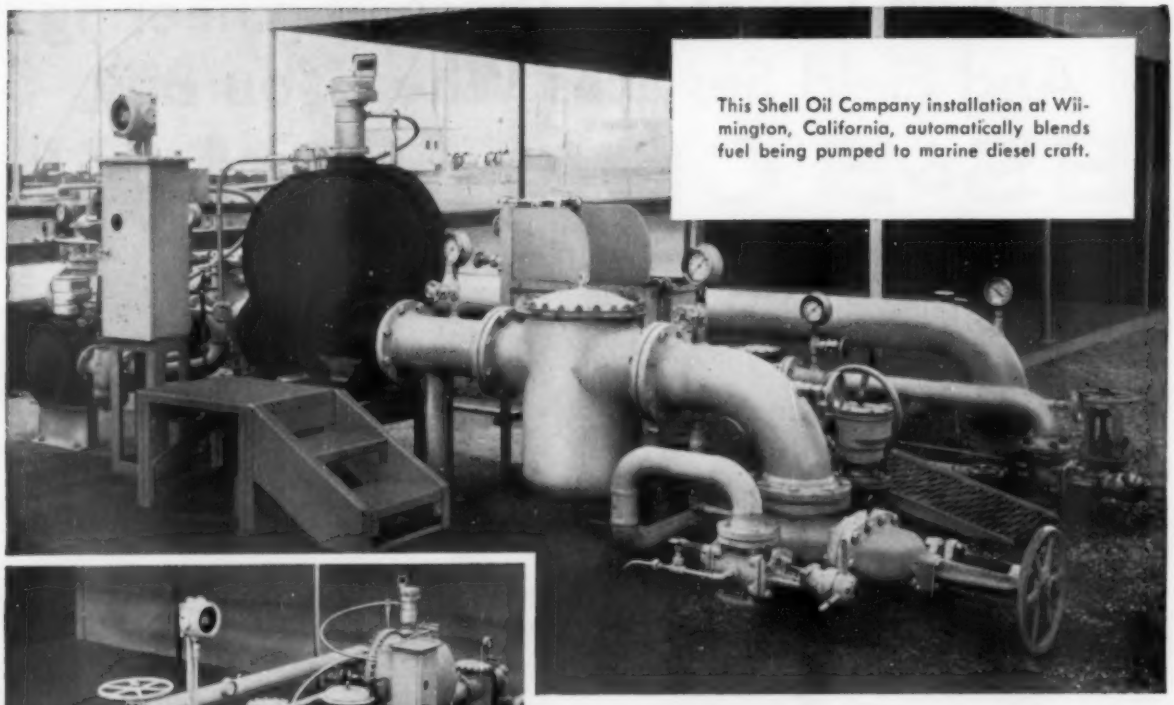
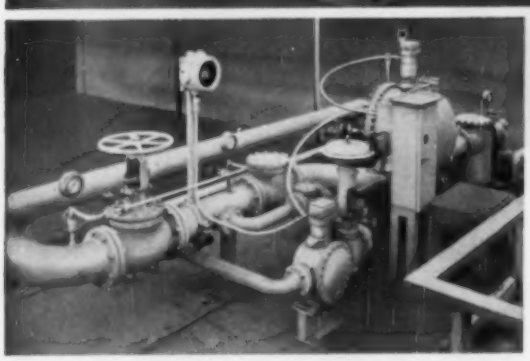


This Shell Oil Company installation at Wilmington, California, automatically blends fuel being pumped to marine diesel craft.



Cables from Brodie Meter counter drive takeoffs can be seen leading to control cabinet.

Blending in the line with the sustained accuracy of Brodie *BiRotor* Meters speeds dockside diesel fueling

Direct mechanical cable connections to the counter drives of two Brodie Meters actuate a proportioning pilot system. This, in turn, controls a valve modulating the blend into the main line stream. An accurate record of each product metered is provided, with uniform control of the blend, and full flexibility to deliver any desired proportion at a moment's notice. It eliminates blending tankage, gauging errors, evaporation losses, and possible overages. For the most effective automation in metering, contact your Brodie representative.

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The Oil and Gas Department of The National Bank of Commerce of Houston has helped and is helping all of these oil men. The Commerce can help you because it knows what it's talking about, and, even more important from your point of view, it knows what *you're* talking about. If you are planning to drill, if you are planning to extend needed services, if you are in the oil business, you'll find that The National Bank of Commerce will help you all the way.

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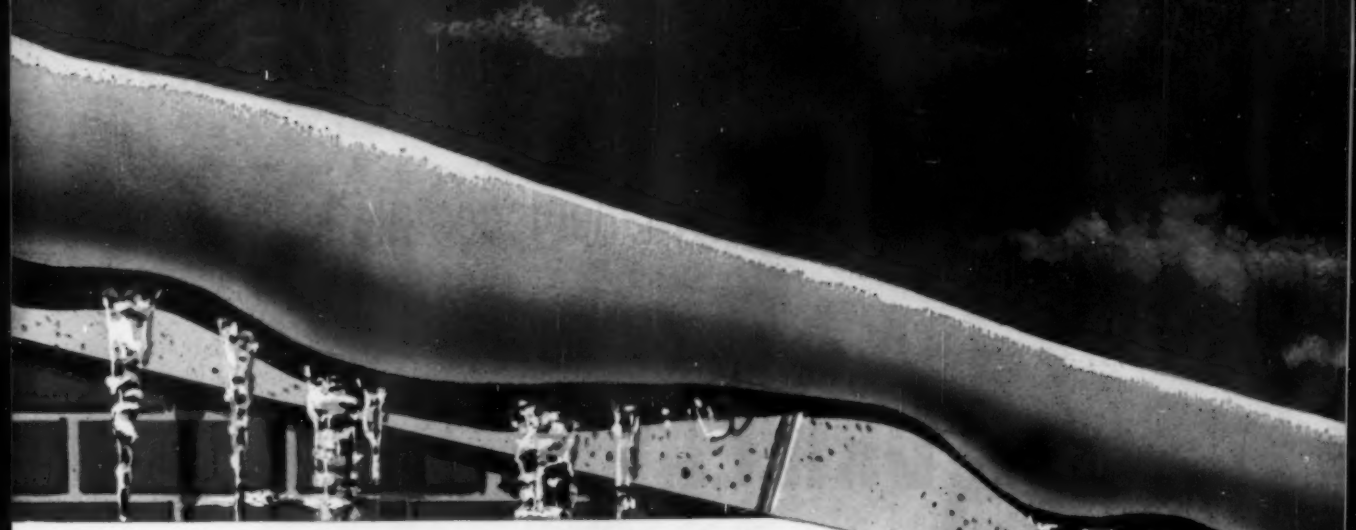

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Call in your nearest Pipe Line Service representative. He can show you how to get the highest possible return on your pipe-protection investment.

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Quality pioneers in coating and wrapping pipe for a quarter century

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Anti-lock prevents relative rotation between anchor cage and tubing while running

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Long, flexible drag springs allow easy recovery in case of washover.

Special seal protects against fouling from sand or scale.

Internal shoulder creates a differential piston inside rubber to cause a tighter seal.

Full setting force is transmitted to packing element through lower head. No scrubbing action between lower slips and casing wall during setting stroke.

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TYPE A DRILLABLE PACKER

runs and sets easily, quickly

- ***Built-in safety against premature setting***
- ***Set and produce in ½ tubing trip***
- ***Unequalled rubber seal***

Guiberson Type A Drillable Packer gives you a versatile packer for many uses..single or multiple zone production, acidizing, pressuring operations, water-flooding, testing, corrosion control and many others.

New safety factors against premature setting are provided since the transmitting of drag from tight casing or impact from junk is direct to the tubing string.

The Type A can be set and placed in production with only ½ tubing trip. Spacing problems are easier, especially when run in combination with a multiple zone packer. From rig floor to completion, the Type A runs and sets faster than any other permanent packer.

Guiberson superior quality rubber and special lead-alloy thimbles compress fully for a leak-proof seal. Setting is quick, easy and uncomplicated..may be set by wire line. Available in 5" through 7⅝" sizes for 2" or 2½" tubing with a full line of stingers and accessories. Ask your Guiberson representative for a recommended installation or write for full details.

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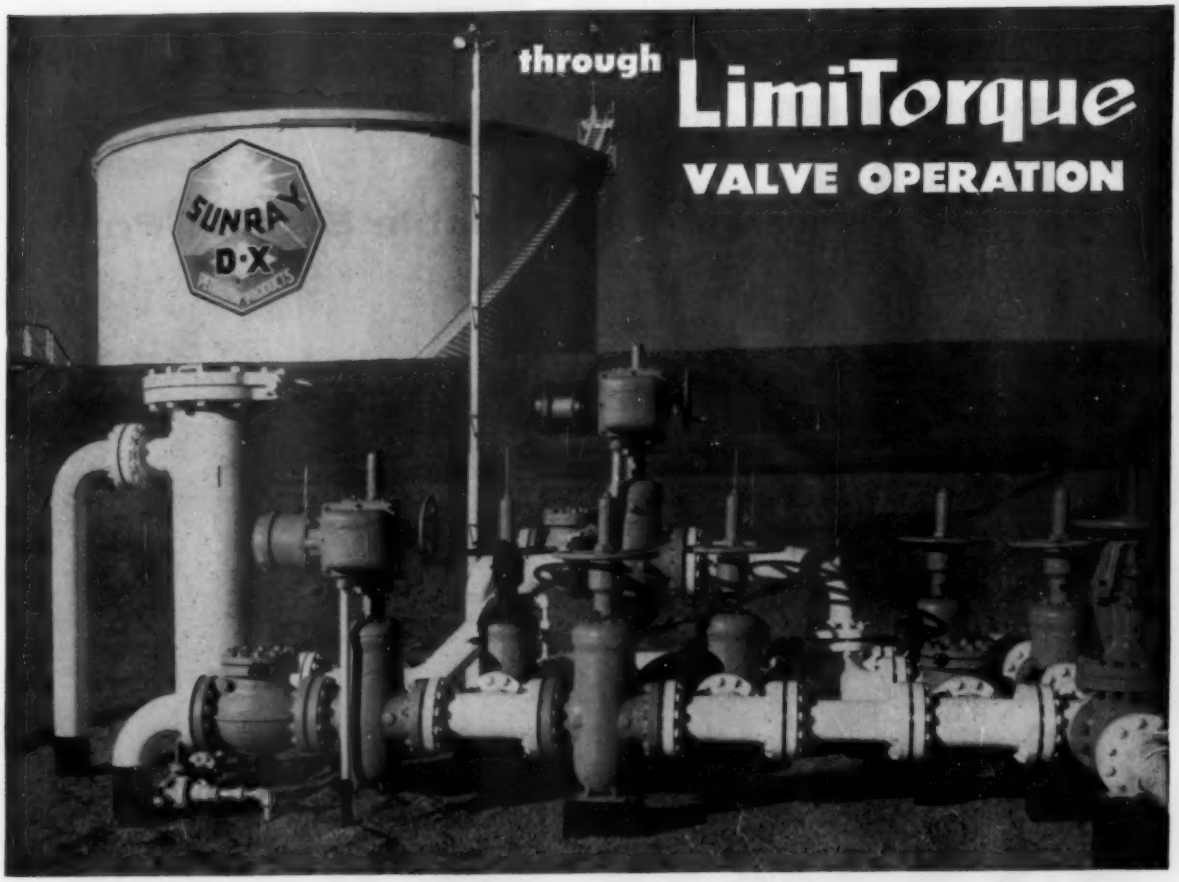

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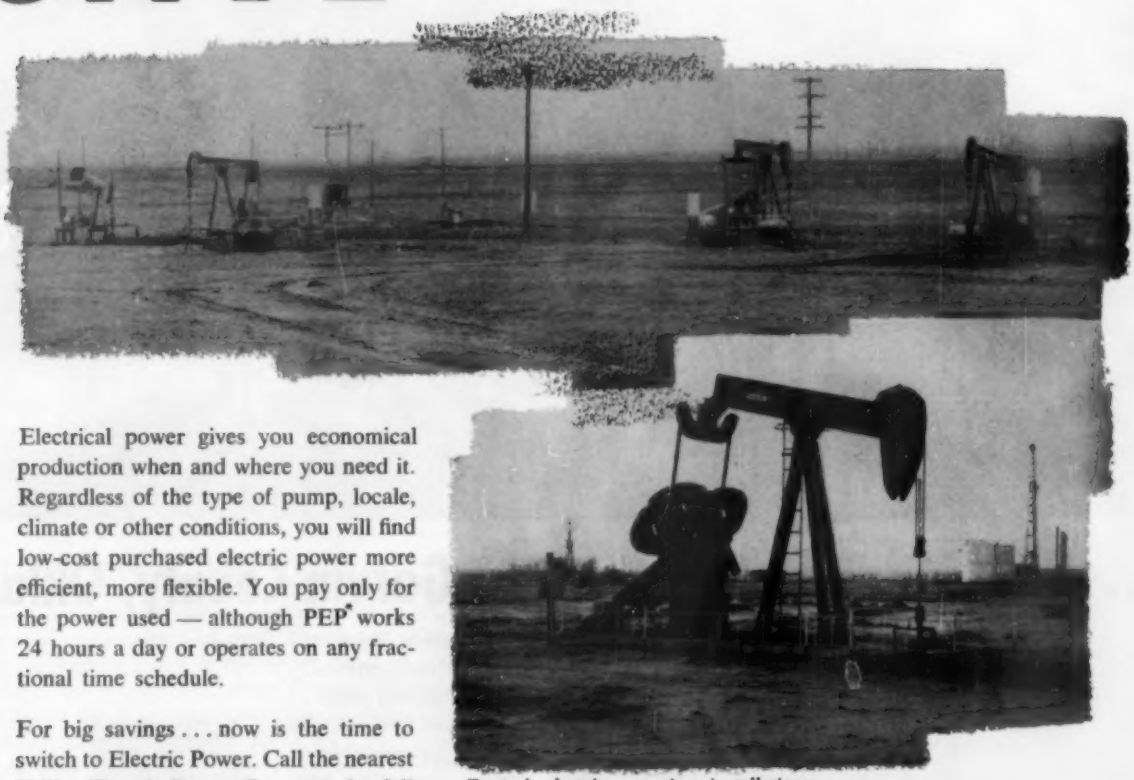

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Carbon, ½ Mo	5 Cr, ½ Mo, 1½ Si	18-8
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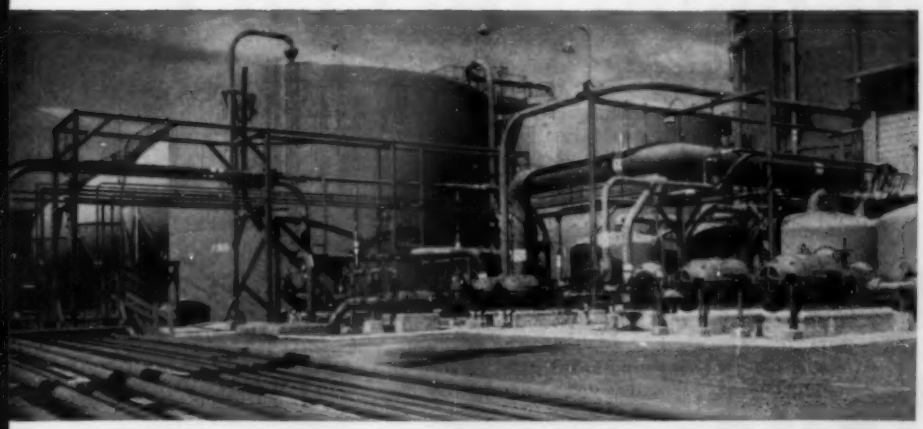
1¼ Cr, ½ Mo	8 Cr, ½ Mo	18-8 Cb
2 Cr, ½ Mo	8 Cr, 1 Mo	18-8 Mo
2¼ Cr, 1 Mo	9 Cr, 1 Mo	25-20
2½ Cr, ½ Mo, ¾ Si	12 Cr	3½ Ni
3 Cr, 1 Mo	12 Cr, Al	5 Ni



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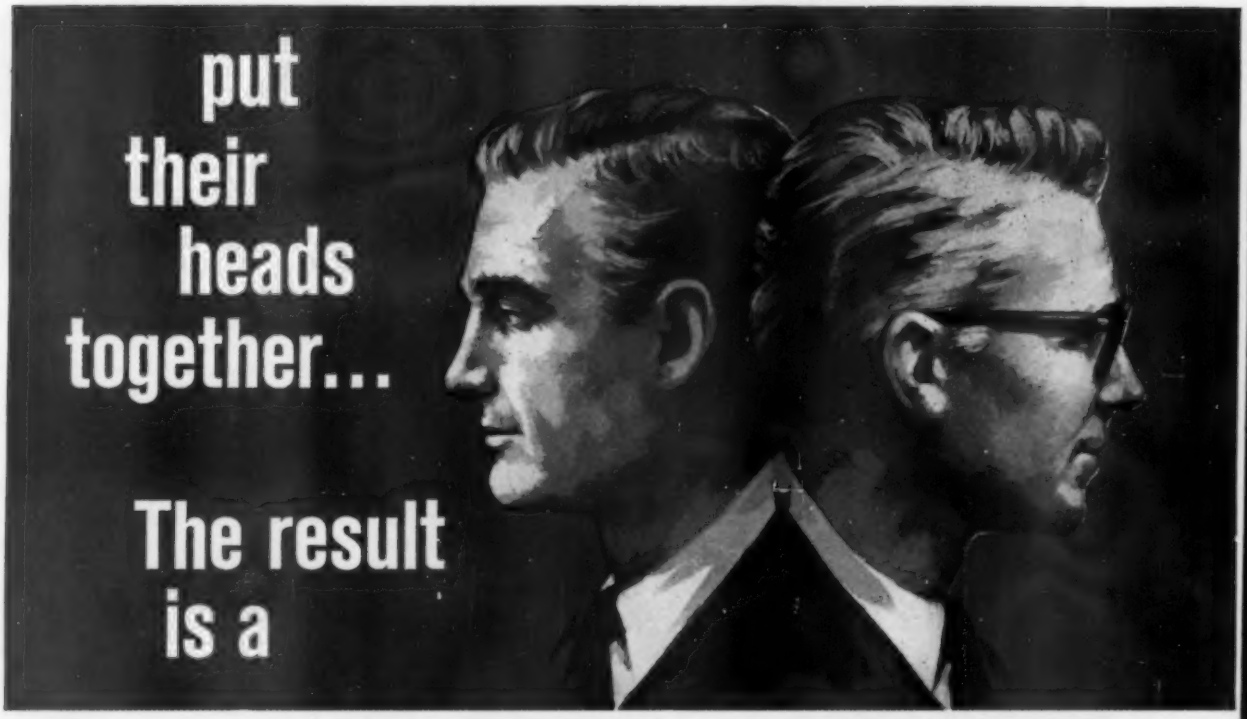

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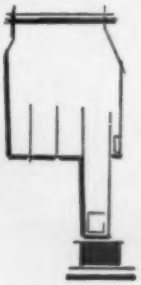
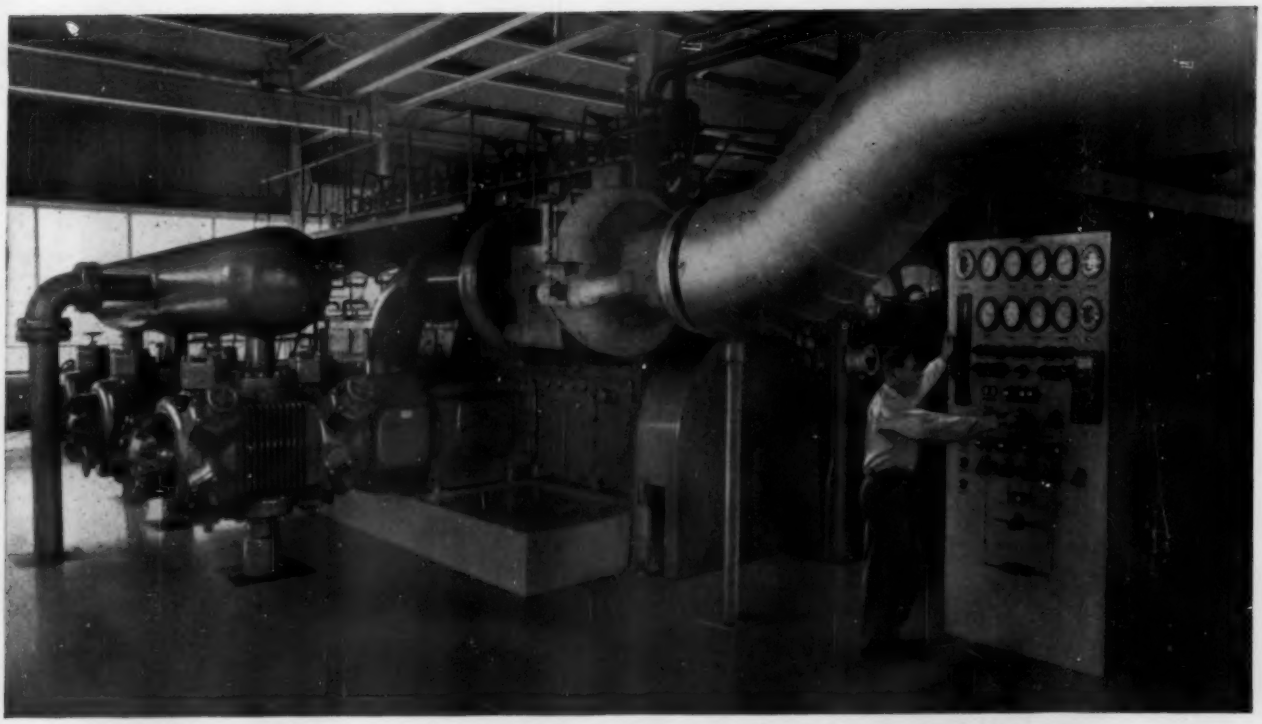
FROM STOP
TO FULL LOAD IN MINUTES!

The Clark-designed Fully Automatic Control Panel starts the engine automatically, allows a warmup period, sequences the valves for purging and blow down, and puts the compressor on line—with a single push of the start button. In case of temperature and pressure malfunction, it will give an alarm signal... and upon continued malfunction, it will shut down the engine and sequence the valves to their off-line position. A single push of a stop button will accordingly remove the unit from service whenever required.





PANEL FOR OPERATING PIPELINE COMPRESSORS!

Problem: Northern Natural Gas Company wanted to centralize and simplify all of the starting and successive functions involved in putting their new Clark TLA-6 Compressor engines on line—in a matter of minutes, with all due safeguards against malfunction.

Solution: Engineers at Clark and Northern Natural Gas Company put their heads together—and off their planning boards came the fully Automatic Control Panel now in successful operation. A simple push of the button sets off an automatic multi-phased starting and warmup operation, with precision timed and preset selections...puts the pipeline compressors on line within minutes ...controls the smooth, uninterrupted compressor service throughout.

This is another example of Clark's expert collaboration with the gas industry in devising ever-better solutions to pipeline problems... another instance of the value to be derived from the Clark *encyclopedia of experience.* For more facts on how Clark can help you solve compressor problems call your nearby Clark representative. Write today for Bulletin No. 151, to 1104 Lincoln Avenue, Olean, New York.

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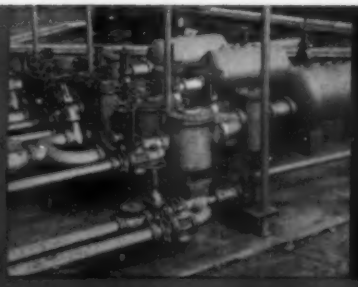
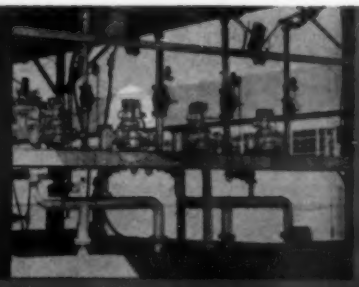
TURBOCHARGED COMPRESSORS

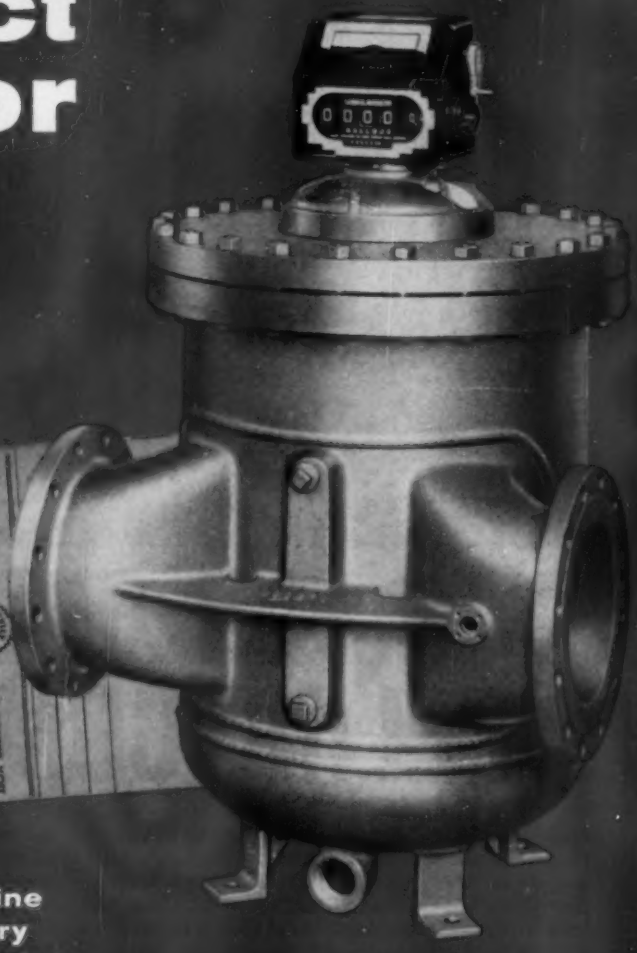
Typical Installations of A. O. Smith Meters





Perfect Auditor

for any pipeline storage or transfer point



A. O. Smith positive displacement line meters account for every drop . . . *print* a permanent, tamper-proof record . . . simplify your bookkeeping

A. O. Smith developed the first rotary meter — proven over the years in accuracy and reliability. Now, we are expanding the scope of use of these meters by utilizing them as accounting machines. Let us tell you about it. Contact your nearest representative. Or write direct.

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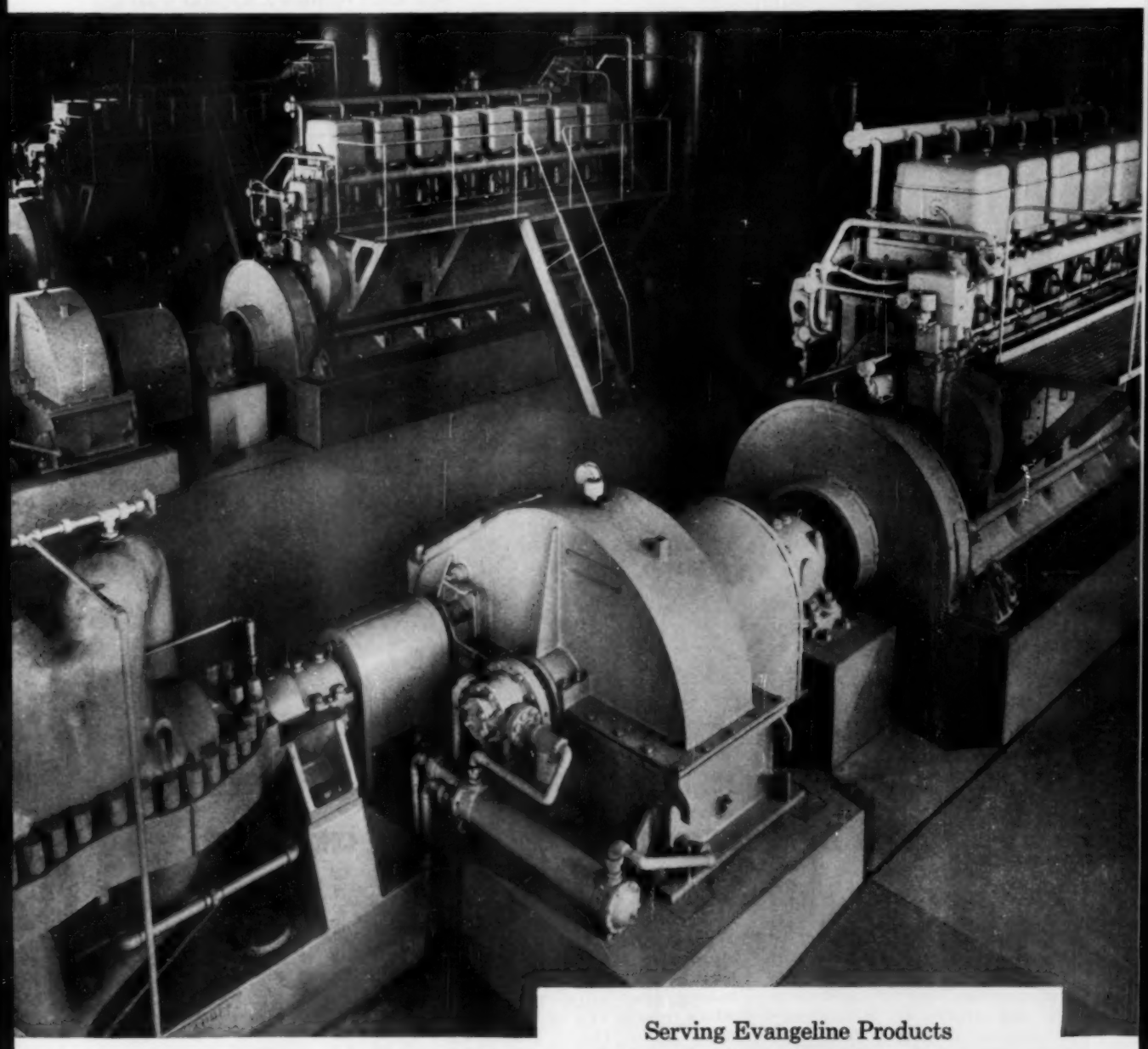
NORDBERG ENGINES FOR PIPE LINES



Serving Evangeline Products Pipe Line System satellite stations

Unattended operation and remote control of six Nordberg engine-pumping units is the feature of the Evangeline Products System's expansion. Nordberg 1720 hp, four-cycle *Supairthermal*® 8-cylinder engines are installed in two identical, full satellite pumping stations on this 16-inch products pipe line.

NORDBERG MFG. CO., Milwaukee 1, Wisconsin

SEND FOR NEW PIPE LINE BOOKLET
Illustrating the application of Nordberg engines on crude, products and gas pipe lines, and graphically describing Nordberg's facilities and ability for producing these heavy duty prime movers.

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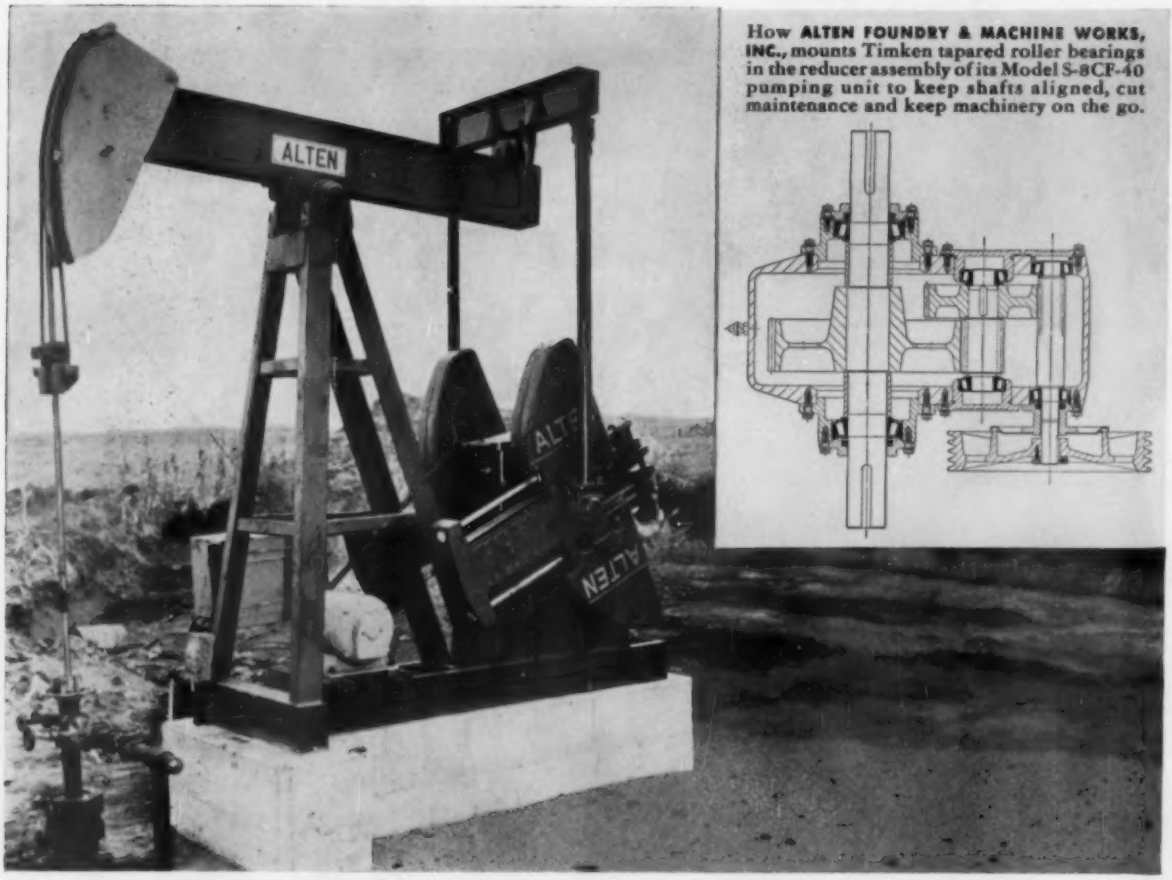


How **ALTEN FOUNDRY & MACHINE WORKS, INC.,** mounts Timken tapered roller bearings in the reducer assembly of its Model S-8CF-40 pumping unit to keep shafts aligned, cut maintenance and keep machinery on the go.

Oil pumping unit is 'all pump—no slump' with shafts on TIMKEN® bearings

ALTEN Foundry & Machine builds pumping units like this Model S-8CF-40 for the rugged service of the petroleum industry. Because every part is engineered to give uninterrupted field operation, Alten units perform to full-rated capacity day in, day out—pumping oil from deep wells. With the slow speed shaft, intermediate shaft and high speed shaft of the reducer assembly mounted on 6 Timken® bearings, the pump keeps on the go with maximum efficiency. Costly shutdowns are prevented.

Tapered construction lets Timken bearings take radial and thrust loads in all combinations. You get extra load-carrying capacity—with full line contact between rollers and races. By keeping shafts concentric with housings, Timken bearings make closures more effective in keeping lubricant in, dirt, dust out. Timken bearings practically eliminate friction, which reduces wear on related parts, prolongs life. They're geometrically designed to give *true rolling motion,* precision-manufactured to do just that in actual daily service. We even make our own steel, which no other American bearing maker does.

Insist on the precision and high quality of Timken bearings, as Alten has done for many years. When you build or buy machinery for the petroleum industry, look for the trade-mark "TIMKEN" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

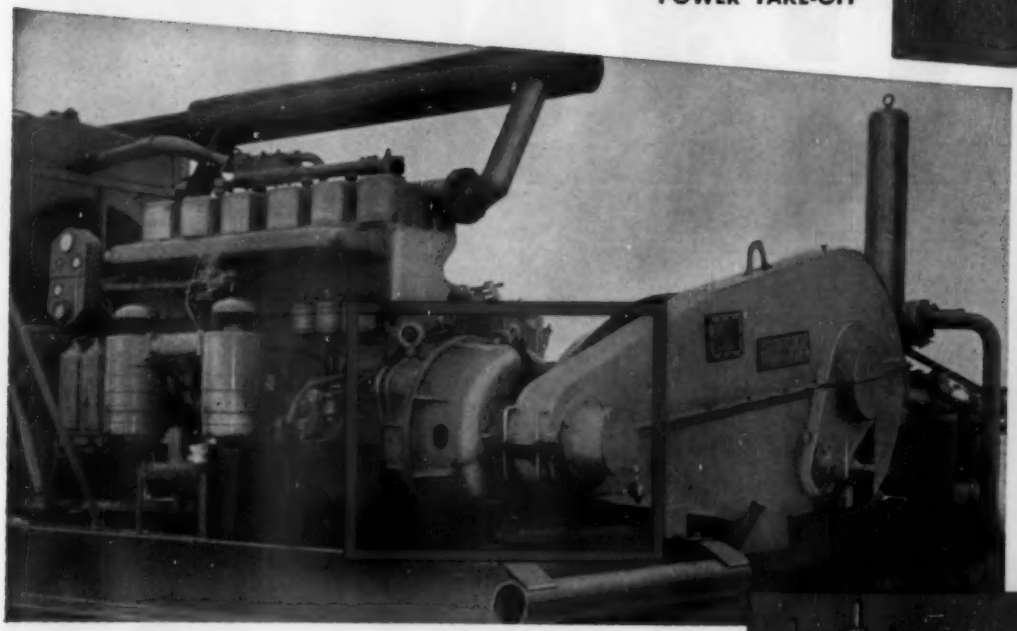
TIMKEN TRADE-MARK REG. U. S. PAT. OFF.

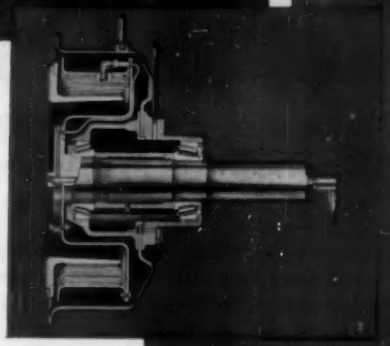
TAPERED ROLLER BEARINGS ROLL THE LOAD

Air Controlled Shock-Free Operation with FAWICK PTO*

*POWER TAKE-OFF

Another Field-Proved Product Supplied by Mid-Continent





Air operated Fawick PTO has self-adjusting CB air-flex clutch and rugged anti-Friction shaft bearings.

The air operated Fawick Power Take-Off provides an ideal shock-free independent pump drive and may be remotely controlled from the driller's position. Heavy duty bearings and rugged bell housing eliminate the need for pilot bearing or outboard bearing. The Fawick PTO offers dollar savings in initial installation too, because it requires no special adapters, skids or outboard bearings. It bolts directly to the engine flywheel and flywheel housing. V-belt or chain drives are easily installed or removed from the open end clutch shaft, speeding up rig-up time. For complete information on the Fawick PTO, contact your Mid-Continent representative. Mid-Continent stores, sales offices and sales representatives are located in all active oil areas.

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This new FORGED STEEL GLOBE VALVE offers maximum strength and safety...longer life!

• R-P&C's new F80 Forged Steel Globe Valve is a versatile, precision-built addition to a distinguished valve family. Designed and engineered in cooperation with many of the country's leading engineers of the power, process piping and shipbuilding industries, the F80 Globe Valve is manufactured to the most rigid standards to overcome the problems of ever-increasing temperatures, pressures and corrosion.

Here are a few of its many features that insure greater strength and safety, longer service life and lower maintenance cost: Forged Steel body, bonnet and gland..."375 Brinell" stem with rolled stem threads..."500 Brinell" disc-lapped seat face...molded, reinforced asbestos packing. Test Pressures: Hydrostatic Shell test, 2500 P.S.I....Seat Test (air under water), 100 P.S.I....Pneumatic Testing at 300 P.S.I. when specified. For details, *write for Folder DH-213.*

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BRONZE GATE VALVE

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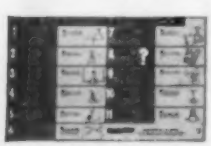

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"How to Protect Your Valves"
Installation pointers, operating tips, clues to longer valve life. They are all on this 22" x 17" wall chart. Write for your free copy.

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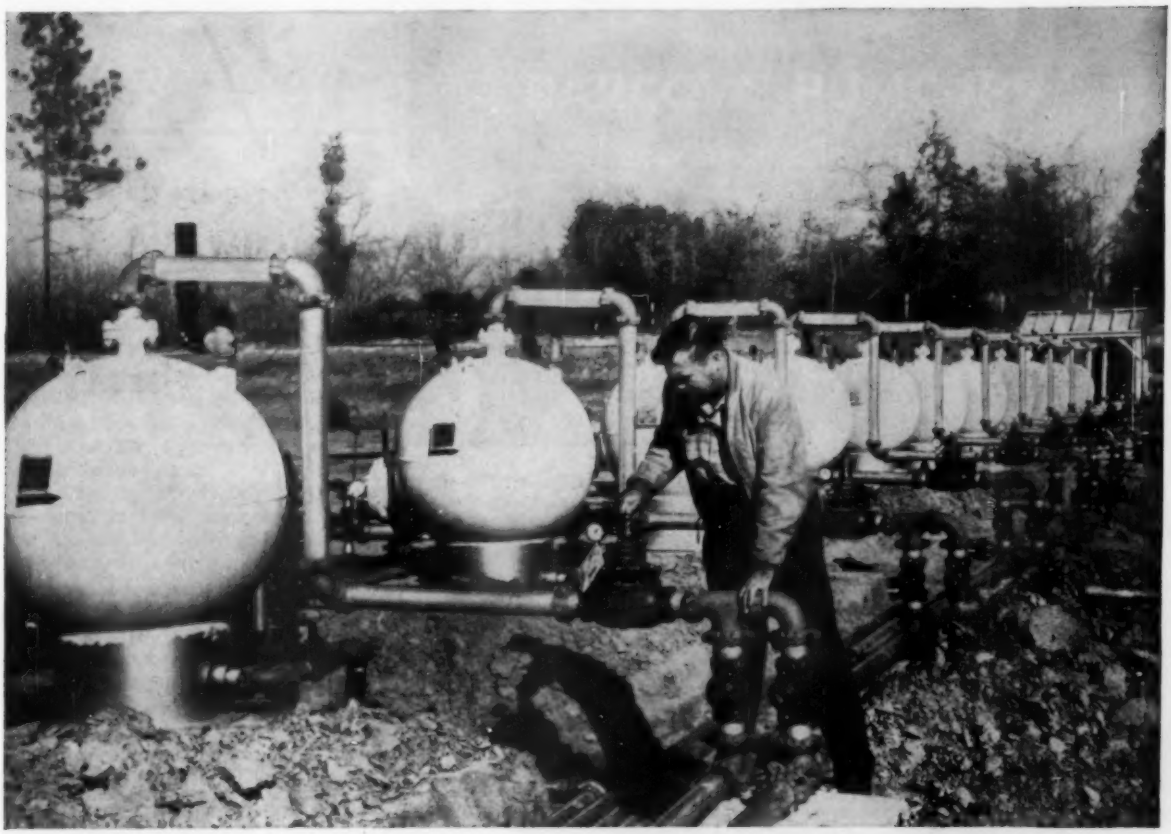

350,000 ft of this lightweight, corrosion-resistant piping of Alcoa Aluminum form flow lines, gathering lines and tank battery lines. The pipe's light weight keeps laying costs low by making possible larger truck loads, smaller crews and faster laying. Excellent corrosion resistance gives the aluminum pipe long service life with no maintenance.

Light, strong, corrosion-resistant...

Alcoa Aluminum Pipe links well heads with tank batteries for major oil producer

A major oil producer now joins well heads with tank batteries in a new field through some 350,000 ft of light, strong, corrosion-resistant ALCOA® Aluminum Pipe. Why? The reasons are simple.

The company has found that the light weight and handling ease of aluminum pipe mean important savings in pipe laying costs. Such savings have run as high as 77%. Still other economies are possible in service because of the excellent corrosion resistance of aluminum pipe and its good mechanical properties. The important net result is this: piping that is very frequently the most economical in terms of actual cost per foot in service.

You, too, will find that portable piping of ALCOA Aluminum is frequently the best and least costly answer to your oil country piping needs. It is available in quantity through most major oil field supply houses. Quick couplers of aluminum are available for temporary lines through the same suppliers.

Get the full story of the many benefits you get when you use portable piping of ALCOA Aluminum. Mail the coupon now to get your free copy of the descriptive booklet, *Portable Oil Country Service Piping*.

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They Say-

Who holds safety record?

Dear Sir:

In the June 16 issue of The Oil and Gas Journal on page 135 there is an article about a Falcon Seaboard driller setting a safety record.

I wish to contest this . . . I hold a safety record without a lost time accident for myself or my crew while drilling through 1949, '50, '51, '52, '53, and '54 (6 years). At the time I received my award from the American Association of Oilwell Drilling Contractors there were a few other drillers that had my record beaten and also received awards.

I am now pushing tools on rig No. 5 for Gulf Coast Drilling & Exploration, Inc., Laurel, Miss. We are drilling a 13,300-ft. wildcat for Jett Drilling Co. in 32-10n-14w, Smith County, Mississippi, near Taylorsville, Miss.

B. B. Robinson
Laurel, Miss.

Anti-Americanism in Canada

Dear Sir:

I was very pleased to see the article by Mr. Gardner regarding the oil industry in Canada . . . ("Canada: Prime Hunting Ground for Oil," p. 51, May 26).

The lack of a market for western crude is the fault of the big international oil companies such as Shell Oil, Imperial Oil and others who wish to protect the investment they have in Middle East crude and South American wells. . .

However, I am not anti-American, as it is not the Yanks' fault for trying to take over our country but the fault of our last government which encouraged them to do so. . .

Mr. Gardner said that there is not anti-Americanism in the west and I would apply this to the east too, but there is a pro-Canadianism in all the country.

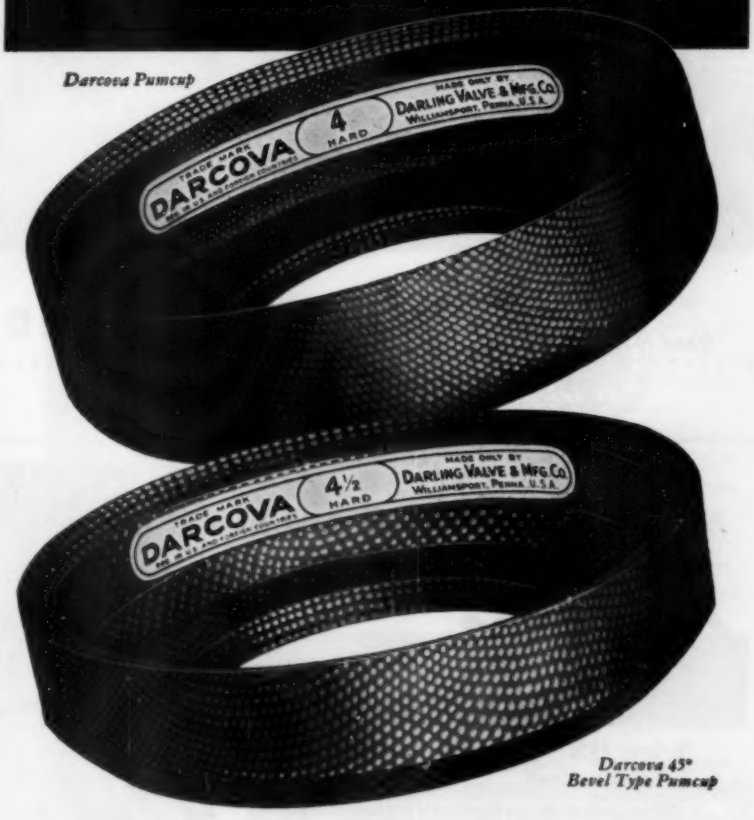
Kelly Royle-Thome
Port Radium, N.W.T.

UOP leads way in Japan

Dear Sir:

The second item in the "World Briefs" section of the Journal for June 23 (p. 90) has attracted more than passing interest here—astonishment, first; then amusement. It says: "The Far East's first catalytic re-

DARCOVA PUMCUPS
now available with
100% NYLON COMPOSITION
for HYDRAULIC CONTROLS, AIR CYLINDERS, RECIPROCATING PUMPS



Darcova 45°
Bevel Type Pumcup

DARLING Pumcups—long noted for unequalled efficiency and life in all kinds of cylinders—are now greatly exceeding their own performance records! The new 100% Nylon Composition, available *only* in Darcova Pumcups, does it!

Nylon Pumcups are made in sizes, types and textures exactly right for your particular equipment—ready *now* to give you unprecedented piston packing performance!

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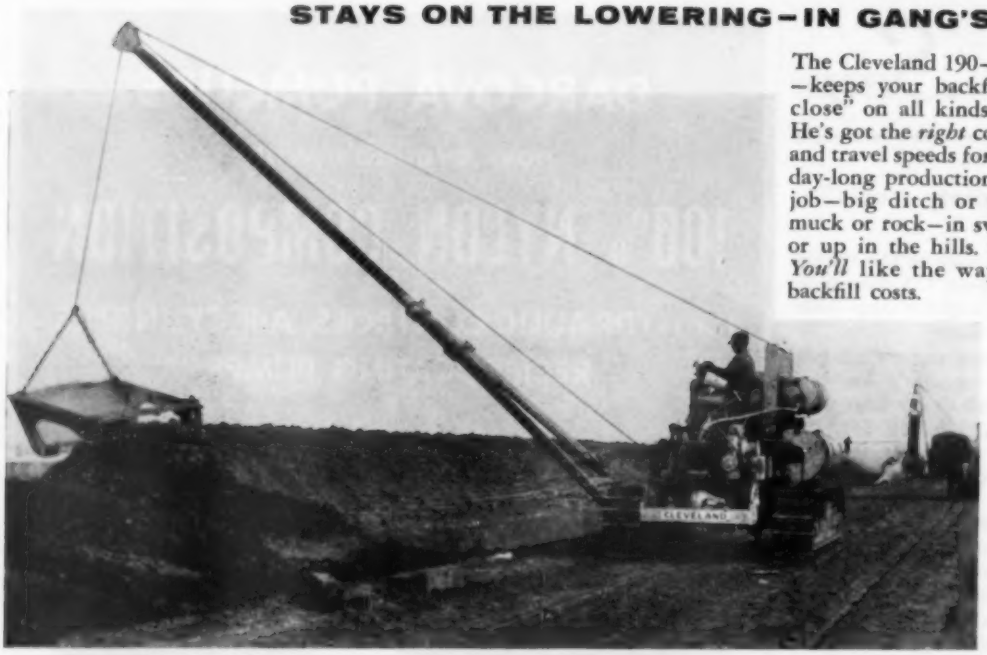
DARCOVA
THE ORIGINAL COMPOSITION CUP
TRADE MARK
PUMCUPS

STAYS ON THE LOWERING—IN GANG'S HEELS



The Cleveland 190—*with just one man*—keeps your backfill operation "up close" on all kinds of pipeline jobs. He's got the *right* combination of line and travel speeds for continuous, high, day-long production on *every* backfill job—big ditch or small—dirt, sand, muck or rock—in swamps, on the flat or up in the hills. Operators like it. *You'll* like the way it lowers your backfill costs.

Good Everywhere

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Check these advantages and you'll install

Chance PIPELINE Anchors

- Costs 85% less
- Easier to install
- Less weight to transport
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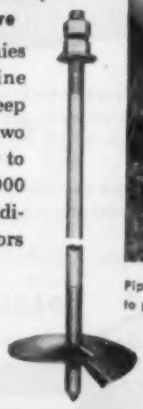
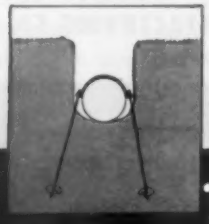
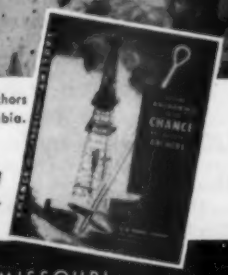
More and more progressive pipeline companies and contractors are turning to Chance Pipeline Anchors to eliminate costly counter weights to keep pipe from floating. A complete unit, consisting of two anchors and pipe saddle bracket, weighs from 29 to 180 pounds and will hold from 5,000 to 30,000 pounds. The anchors can be installed without additional excavation. Light power tools screw the anchors down in seconds.





Cut away view of anchors and bracket installed in trench.

Pipeline crew installing Chance Pipeline Anchors to prevent floatation problems in British Columbia.



Write for complete catalog and application information.

A·B·CHANCE CO· CENTRALIA, MISSOURI TORONTO, ONTARIO, CANADA

former, a 3,000-bbl. Houdriformer, went on stream last week at . . . Yokkaichi, Japan. . ." Tch! Tch!

This unit perhaps is the first Houdriformer in Japan, but by no means is it the first catalytic reforming installation in that country. The first two UOP Platforming units to be installed in Japanese refineries went on stream within a week of one another in December, 1953.

They have been followed by a number of others in the intervening period. To our knowledge, these two "first" Platformers were the first catalytic reforming units to be built in Japan. Your own back issues should bear us out on this point.

D. P. Thornton, Jr.
Public Relations Department
Universal Oil Products Co.

Gas without a market

"Canadian operators have gone through many years of exploring and developing gas reserves without markets, and it is our view that many of them may not survive unless substantial markets are soon available.

"The immediate problem facing the industry is development of gas markets which will provide a return on the large frozen investments already made, and furnish the funds necessary to carry on with further utilization of Canada's natural gas resources. . .

"If the industry has to wait 25 years to market the natural-gas reserves already found, the gas industry will never mature. . . If markets are available, we feel that more than 100 trillion cubic feet can be discovered in the next 25 years."

E. D. Loughney, senior vice president, British American Oil Co., in a speech to the Canadian Gas Association.

CALENDAR

JULY

23-26 Wyoming Geological Society, thirteenth annual field conference, Powder River basin.

24 Illinois Oil and Gas Association, American Petroleum Institute, joint meeting and annual oil men's outing, Meadow Woods Country Club, Centralia, Ill.

25 Southern Gas Association, round-table conference on compressor station operation, transmission gas measurement superintendents' round-table, St. Anthony, San Antonio, Tex.

AUGUST

11-14 Society of Automotive Engineers, National West Coast meeting, The Ambassador, Los Angeles.

18-19 North Dakota Oil and Gas Associa-

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PULSATION CONTROLS CORPORATION

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NOISE and PULSATION CONTROL DEVICES

scientifically designed by EVERETT

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Since the first Everett device was installed in 1921, the line of products has steadily grown to include pulsation and noise-control equipment for practically every need in refineries, chemical and steam plants, engine and compressor stations and aircraft jet engine test equipment.

Because of the tremendous need in the noise and pulsation abatement fields, we are now, through Pulsation Controls Corporation, a company licensed by Everett, producing and distributing these fine products for both domestic and foreign markets. These unique devices employing Everett patents and built without the use of moving parts have outperformed all others in efficiency and with the least pressure drop.

Engineering brochures and case histories have been prepared for you describing each product. You are cordially invited to request data on any or all Everett devices. By comparison you will be amazed with the performance!

NO MOVING PARTS . . . LOWEST PRESSURE DROP

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Pulsco representatives are engineers in sound and pulsation control. Feel free to consult them concerning your particular problem.

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SAN FRANCISCO YUkon 2-0800 EL PASO PRospect 2-1029
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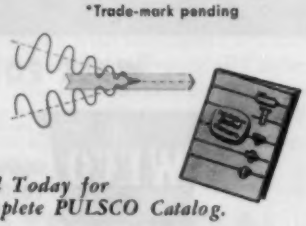
*Trade-mark pending



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Standardize with WECO Unions on all your piping for leakproof connections and simplicity of make-up. When you standardize with WECO Unions no time is lost in locating matching unions. WECO Unions in same sizes and pressures not only match perfectly with each other but are unsurpassed for making and holding a tight seal under all conditions of surge and vibration.

Full circle contact of the ball and cone metal-to-metal seats always makes a tight seal.

Save money and time, standardize on WECO Unions, proved best on the hardest service applications. At your Supply Store in sizes 1″ through 12″, pressures 1,000 psi through 15,000 psi.

U-6-50

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HOUSTON, TEXAS

WECO

Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

tion, annual meeting, Grand Pacific Hotel, Bismarck, N. D.

18-20 American Institute of Chemical Engineers, American Society of Mechanical Engineers, second annual heat-transfer conference, Edgewater Beach Hotel, Chicago.

19-22 American Institute of Electrical Engineers, general meeting, Sacramento.

25-27 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

SEPTEMBER

7-12 American Chemical Society, fall meeting, Chicago.

10-12 National Petroleum Association, fifty-sixth annual meeting, Traymore Hotel, Atlantic City, N. J.

10-13 Intermountain Association of Petroleum Geologists, ninth annual field conference, Paradox basin.

14-19 Instrument Society of America, thirteenth annual instrument-automation conference and exhibit, Convention Hall, Philadelphia.

15-16 Independent Natural Gas Association of America, annual membership meeting, Roosevelt Hotel, New Orleans.

15-17 American Institute of Electrical Engineers, conference on petroleum, Baker Hotel, Dallas.

18 Natural Gasoline Association of America, Rocky Mountain regional meeting, Gladstone Hotel, Casper, Wyo.

21-24 American Society of Mechanical Engineers, petroleum division, mechanical engineering conference, Cosmopolitan Hotel, Denver.

24-25 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

25-26 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

29-Oct. 3 Society of Automotive Engineers, national aeronautic meeting, aeronautic production forum, and aircraft engineering display, The Ambassador, Los Angeles.

OCTOBER

1-2 Western Petroleum Refiners Association, third annual stream-pollution and waste-disposal conference, Lassen Hotel, Wichita.

1-3 American Association of Oilwell Drilling Contractors, eighteenth annual meeting, Adolphus and Baker Hotels, Dallas.

3 American Institute of Chemical Engineers, South Texas section, thirteenth annual technical meeting, Moody Center, Galveston, Tex.

5-8 Society of Petroleum Engineers of AIME, fall meeting, Houston.

5-8 National Association of Corrosion Engineers, northeast region, Somerset Hotel, Boston.

7-8 Texas Mid-Continent Oil and Gas Association, annual meeting, Statler-Hilton Hotel, Dallas.

9-10 California Natural Gasoline Association, thirty-third annual fall meeting, Huntington-Sheraton Hotel, Pasadena, Calif.

12-18 OIL PROGRESS WEEK.

13-15 American Gas Association, annual convention, Atlantic City, N. J.

13-15 American Society of Mechanical Engineers, American Society of Lubricating Engineers, conference on lubrication, Statler Hotel, Los Angeles.

compressor-user survey shows

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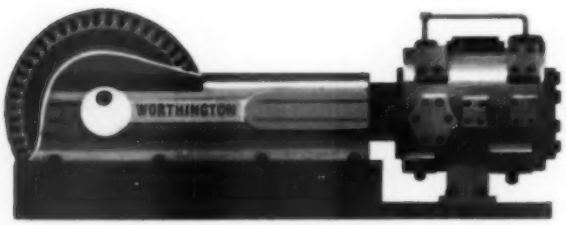
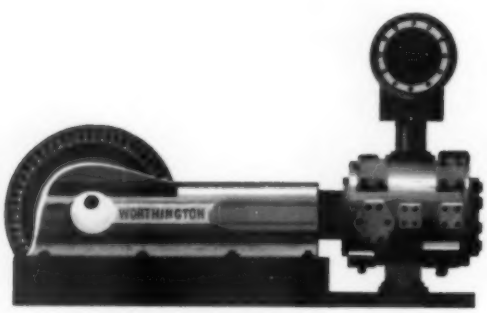
WORTHINGTON

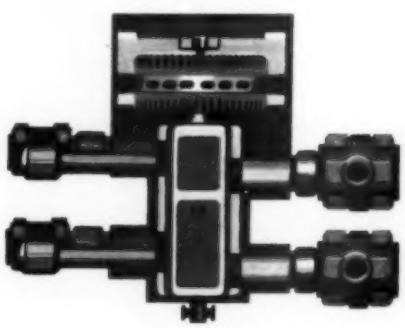


Single horizontal compressor, type HB
5 to 150 hp—Bulletin L-640-B1E

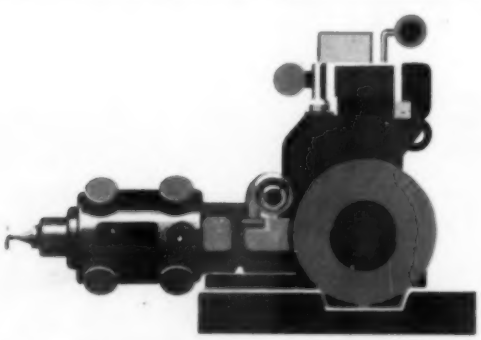
Vertical angle compressor, type YC & DYC
75 to 500 hp—Bulletin L-676-B1A



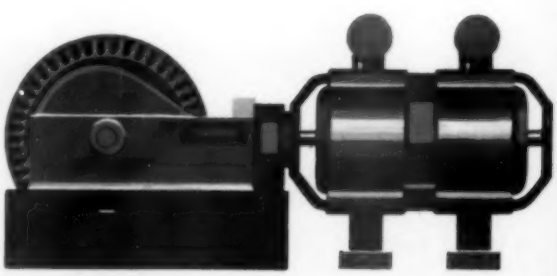
Horizontal duplex compressor, type DC
250 to 3,000 hp—Bulletin L-675-B1C



Balanced opposed compressor, type BDC
400 to 10,000 hp—Bulletin L-679-B1A



Angle gas-engine compressors, types SLHC and SUTC
375 to 2,500 hp—Bulletin S-550-B27; S-550-B23D



Vacuum pump, 200 to 150,000 CFM—Bulletin L-600-B9-4

13-16 Society of Exploration Geophysicists, annual meeting, Hotel Gunter, San Antonio, Tex.

13-17 American Society of Civil Engineers, annual convention, Hotel Statler, New York.

15-16 South Dakota Independent Oil Men's Association, convention, Sheraton-Johnson Hotel, Rapid City.

15-17 National Association of Corrosion Engineers, north central region, Cincinnati.

16-17 Society of Petroleum Engineers of AIME, Southern California petroleum section, Biltmore Hotel, Los Angeles.

16-18 New Mexico Geological Society, Arizona Geological Society, ninth annual field conference, Black Mesa basin, registration Gallup, N. M., Oct. 15.

19-21 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Adolphus, Dallas.

20-24 National Association of Corrosion Engineers, south central region, Roosevelt Hotel, New Orleans.

22-23 National Association of Corrosion Engineers, western region, corrosion control course, U. S. Grant Hotel, San Diego, Calif.

22-24 Southwestern Federation of Geological Societies, technical meeting, Mineral Wells, Tex.

22-24 Society of Automotive Engineers, national diesel engine meeting, Lord Baltimore Hotel, Baltimore.

23-24 Rocky Mountain Oil and Gas Association, annual fall meeting, Town House Motel, Omaha.

23-24 Western Petroleum Refiners Association, refining technology and industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

27-28 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

26-31 American Institute of Electrical Engineers, general meeting, Pittsburgh.

NOVEMBER

5-6 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

6-7 American Association of Petroleum Geologists, Pacific section annual meeting, Los Angeles.

10 Transportation Club of the Petroleum Industry, annual meeting, Bismarck Hotel, Chicago.

10-13 American Petroleum Institute, thirty-eighth annual meeting, Conrad Hilton, Palmer House, and Congress hotels, Chicago.

18-20 Ninth National Conference on Standards, Hotel Roosevelt, New York.

21 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

30-Dec. 5 American Society of Mechanical Engineers, annual meeting, Statler and Sheraton-McAlpin hotels, New York.

DECEMBER

1-3 Interstate Oil Compact Commission, annual meeting, Kansas City.

7-10 American Institute of Chemical Engineers, annual meeting, Netherland Plaza Hotel, Cincinnati.

9-13 National Association of Corrosion Engineers, University of Illinois, biennial short course on cathodic protection.

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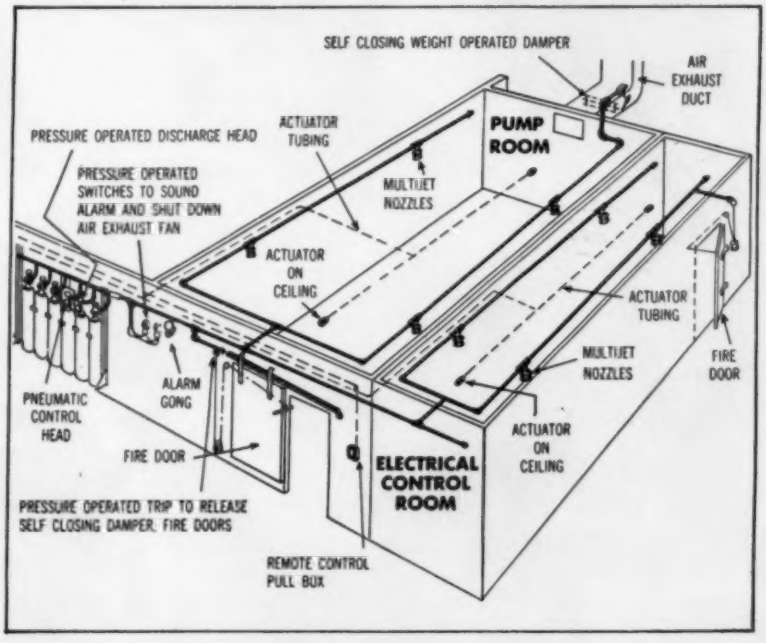

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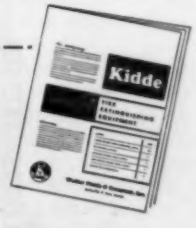

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JOURNALLY SPEAKING

The Forty-ninth Star

A bunch of the boys were whooping it up
in the Malamute Saloon,
For now it was sure that Alaska State
would be in the Union soon.
Back in the States, in a waiting game,
sat oil men ready to drill;
While watching their luck were the tax collectors,
hoping to fill their till.

There's a strong oil flavor to Alaska's celebration of passage of the statehood bill. There is no doubt that discovery of oil in Alaska last year gave a big impetus to the move to transform the territory into the forty-ninth state, and Alaskans are looking to the oil industry to bring the wealth and the people to develop their state rapidly.

This may well happen. As a parallel, look what oil did for Oklahoma. Scarcely more than 50 years ago Indian Territory was poor, sparsely populated, and almost totally lacking in industry. Then oil was discovered, and the influx of people turned such frontier villages as Tulsa, Bartlesville, Ponca City, and Oklahoma City into thriving, prosperous towns, and the new wealth that was developed made it possible for the area to cut the umbilical cord to Washington and make a go of it alone as a sovereign state.

Alaska is ready for the oil industry, and the oil industry is ready for Alaska. How well they will get along together depends in considerable part on how much the new state encourages the industry to get a good foothold before asking it to contribute the lion's share of public finances.

So far the outlook is promising. Even before oil was discovered there, the territorial government made a close study of the experiences of older oil states in fostering the industry's growth, and was ready with a good set of conservation and leasing regulations.

Now that Alaskans will be in charge of their own destiny, free from bureaucratic control by distant Washington, there most certainly will be a rapid increase in the influx of wildcatters to their midst. But it won't be a repetition of the Klondike gold rush—nor of the hectic oil-town booms of the Southwest of even a generation ago.

Today's oil men are a different breed of pioneers. Their daring is tempered with caution. The stakes are high, and they play their cards craftily. But when a strike is made, they move in to stay. They bring their families and build permanent communities.

The Alaska oil rush—and everyone hopes it will be big and lasting—will follow the pattern of such latter-day oil rushes as may be seen in Alberta, North Dakota, and the Four Corners area. Where Alaska's gold rush of '98 was virtually over in a couple of years, its oil rush can be expected to burgeon steadily over a long period, bringing with it permanent industries and settlers to prosper from and with it.

So while Alaskans whoop it up over the advent of statehood, and flag makers worry about where to place the forty-ninth star, and Texas shrugs off jokes about no longer being the biggest state, oil men are quietly assaying their prospects for helping to make the new state an important oil state.

Oil men are accustomed to frontiers and wide-open spaces, and Alaska offers plenty of both. So long as Alaska invites them to wildcat and keeps them encouraged with an occasional good strike, our newest state can look forward to acquiring some mighty fine new citizens from the older oil patches all over the country.

—Henry D. Ralph

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A new policy on Canadian crude may be shaping up

THE seeds for some changes in control of oil imports may have been planted last week during President Eisenhower's discussion with Canadian officials of mutual economic problems of the two countries.

Whatever form the pending reciprocal trade bill finally takes, the President will have considerable administrative leeway to make changes in the operation of the control system with a view to reducing complaints and inequities. One such change could well be a new treatment of Canadian oil.

CANADA'S REQUEST is moderate and logical. It conforms with the major objectives of the control program rather than contesting its basic principles.

These objectives are, first, to enhance national security by minimizing dependence on oil from sources remote and hard to defend, and, second, to keep the domestic industry healthy by preventing it from being swamped by more foreign oil than the market can absorb in an orderly fashion.

Canadian crude, being produced in the middle of the continent and brought to the U. S. by pipeline, is certainly as accessible and defendable in time of war as domestic crude. And U. S. and Canadian military and economic resources would always be pooled for continental defense in any emergency.

Canadian crude is produced in a geologic, economic, and political environment almost identical with the U. S., and its price is based on U. S. prices. Moreover Canadian provinces—alone among foreign producing areas—have market-demand statutes to prevent a flood of excess production.

So Canada asks that its crude be treated as a part of the continental supply and given a preference over offshore imports without increasing the total U. S. imports volume.

This might be done by receiving nominations to import crude by pipeline or from countries not net exporters of petroleum, and subtracting this quantity from the total imports level before apportioning the rest. This type of preference would not necessarily violate our foreign policy of nondiscrimination nor require setting up import quotas for other countries.

SOME SUCH PREFERENCE PLAN would aid our nearest neighbor, closest ally, and best customer without disrupting the import-limitation scheme or threatening the domestic industry seriously. It could well be accompanied by a Canadian agreement to limit her own offshore imports to prevent them from pushing more prairie-province oil into the U. S.

Other exporting countries might find this preferable to an alternative getting much discussion in Canada: Exclude all imports from the Maritime provinces and fill Montreal refining needs with prairie crude which otherwise would find its logical market in the United States.

At 13,000 ft in the Caillou Island Field. The barge *Garry*, lonely outpost in these Gulf Coast waters, is equipped for deep and difficult offshore drilling. The job shown here is typical, with the hole at 13,000 ft and another 1600 ft to go. Location: Caillou Island Field, off the Louisiana mainland.

The *Garry* was custom-built for the Buster Gardner Drilling Co. Because of the heavy loads involved in handling the drill pipe, the owners specified Bethlehem rotary line in the 1⅛-in. size. (At the time of the photograph, this husky wire rope had accounted for 62,000 ton-miles and 55,000 ft of hole.) Also included in the *Garry's* equipment is 9/16-in. Bethlehem coring line with the rust-resistant bethanized coating.

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New Claims for Shale Oil Output

A NEW REPORT on shale oil contains the most optimistic outlook for the toddling industry yet given the U. S.

The University of Denver's Research Institute has released a set of far-reaching claims for the "Aspeco" method of processing oil-shale deposits.

Basing its claims on the operation of a pilot plant in Denver, the institute says:

. . . **A shale-oil industry** is economically feasible in the U. S. right now.

. . . **Shale oil can be delivered** to the West Coast at $1.42 to $1.92 per barrel, exclusive of profit.

. . . **Production** of as much as 1 million barrels daily "in the period from 1970 on would be quite reasonable."

Union's experience . . . While the Research Institute was exuding optimism about its project, Union Oil Co. backed off from a similar project which the company had hoped would prove that shale oil can be produced for the competitive market.

Early this month Union announced it has closed its shale retort at Grand Valley, Colo., "until a better economic climate will permit larger scale operations" (OGJ, July 7, p. 67).

Union spent $9 million over a 3-year period operating a 1,000-ton plant and producing more than 750 bbl. of shale oil daily.

Only last February a Union official said the company had cut the cost of retorting oil shale to "considerably less than $1" and had a target of making it 50 cents (OGJ, Feb. 17, p. 73).

The process . . . The Research Institute has conducted its research and development work under a contract with Oil Shale Corp., Carson City, Nev., owner of the Aspeco process.

At the 24-ton-per-day pilot plant in Denver, the institute has processed oil shale from northwestern Colorado using a method employing heated metal of ceramic balls (OGJ, May 13, 1957, p. 77).

Marketing . . . Shirley A. Johnson, Jr., director of the Research Institute, says that volume production of shale oil would make a pipeline from the Colorado shale fields to the West Coast economically feasible.

Johnson calls the West Coast the "logical market" for Colorado-produced shale oil. California crude last year averaged $3.05 per barrel.

Oil Shale Corp., which released a summary of the Research Institute's report, did not state specifically what costs are included in the $1.42-to-$1.92 delivered price claimed for shale oil. The company said only that the figure is "exclusive of profit."

Whether retirement of plant investment and depletion of reserves are included in the figure was not stated. Profits usually average about 15 cents per barrel after these items are figured in.

What next? . . . Dr. Charles H. Prien of the Institute said the 24-ton pilot plant currently is being revised to make it more efficient.

When this work is completed, the plant will resume operations until the end of the year.

Prien proposed that a plant of 1,200 to 2,400-ton capacity be built on the western slope of the oil-shale deposits near De Beque, Colo. The plant would serve as one unit of a full-scale commercial plant of 8 to 16 such units.

"It is not expected that the economic data from such a semicommercial unit would differ substantially from that obtained from the present pilot plant," Prien said. "Its purpose would be primarily to confirm these calculations and to establish such engineering variables as maintenance, wear, general operating costs, etc. It is hoped that arrangements for construction of such a facility can be completed in the near future."

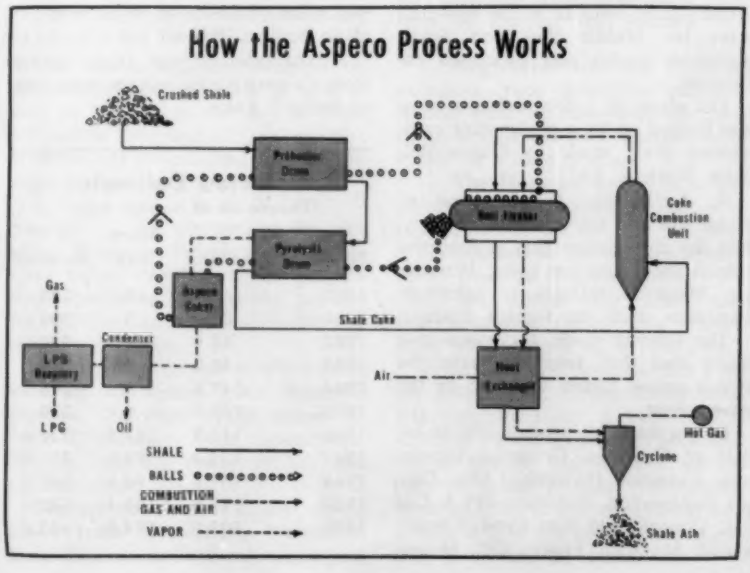
Oil Shale Corp. made no statement on its future plans for developing shale-oil production.

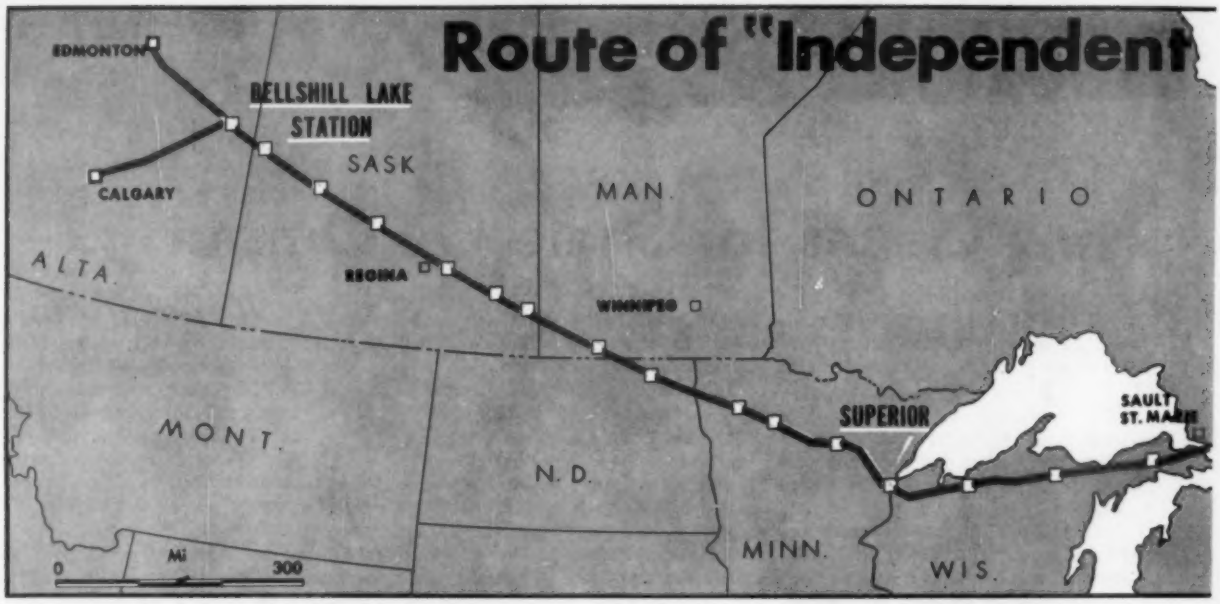
The Government . . . Meanwhile, the U. S. Government may get back into the shale-oil business.

Marling J. Ankeny, director of the Bureau of Mines, said Union's decision to end its Grand Valley operations could mean the Bureau's plant at nearby Rifle will be reopened.

Ankeny inspected the Rifle installation the same day Union announced it will mothball its plant.

The Bureau closed the Rifle plant in 1955 after spending $17 million and 9 years on experimentation.





World's Biggest Crude Line Is Proposed

CANADIAN independents last week made the strongest case yet for opening the Montreal market to their domestic oil. They proposed the longest and biggest crude line ever built.

Home Oil Co. laid before the Borden Commission in Toronto plans for a $395-million, 2,019-mile, 36 and 34-in. line from Edmonton to Montreal, to be called Independent Pipe Line Co.

The line could deliver Alberta crude to Montreal at a price of $3.145 a barrel. This compares with $3.0775 to $3.28 per barrel which Montreal refiners have testified is the delivered price for Middle East and South American crudes now processed exclusively.

The claim of a low delivered cost was backed up by a preliminary engineering study made by Dutton-Williams Brothers, Ltd.

R. A. Brown, Jr., president of Home Oil and the pipeline company, told the commission that government help is needed on one point: Persuading Montreal refiners to substitute Canadian crude for foreign crude.

The refiners made it obvious in a hurry that they wouldn't make the switch unless forced to do so by the government.

Brown made his presentation on behalf of Canadian Devonian Petroleums, Canadian Homestead Oils, Canpet Exploration, Colorado Oil & Gas Co., Consolidated East Crest, Consolidated MicMac, Home Oil, Medallion Petroleums, Merrill Petroleums, Okalta Oils, Westburn Oil Co., and Western Decalta Petroleums.

The 36 and 34-in. line was offered as an alternative to a 30-in. line proposed earlier.

Brown said the new Independent line would cut the cost of crude oil for both Toronto and Sarnia refiners by supplying expanding needs of Interprovincial Pipe Line in these markets at a lower transportation rate.

The pipeline . . . Independent Pipe Line's plan calls for 1,073 miles of 36-in. from Edmonton to Superior and 946 miles of 34-in. on to Montreal—all to built in 1959-60.

A 145-mile, 10 and 16-in. feeder from Calgary would join the main line at Bellshill Lake.

Projected Deliveries

(Thousands of barrels daily)

Year	Superior	North Bay	Montreal
1960	0	0	200
1961	29.4	0	224
1962	58.8	0	248
1963	88.2	0	272
1964	117.6	0	296
1965	147.0	0	320
1966	113.2	67.6	336.4
1967	135.4	79.2	352.8
1968	157.6	90.8	369.2
1969	179.8	102.4	385.6
1970	202.0	114.0	402.0

The line would go into operation in 1961 with six pump stations totaling 23,000 hp. Design throughput would be 259,000 bbl. per day from Bellshill Lake to Superior, 229,000 bbl. from Superior to Montreal.

Ultimate throughput capacity in 1970, with 20 stations aggregating 193,000 hp., would be 733,000 bbl. per day out of Bellshill Lake, 527,000 out of Superior, and 410,000 out of North Bay.

Backers say the line would make Alberta crude competitive without an import duty on foreign crude or a cut in wellhead price, as previously proposed. And it would not raise product prices, Home said, in answering the importers' most persistent arguments.

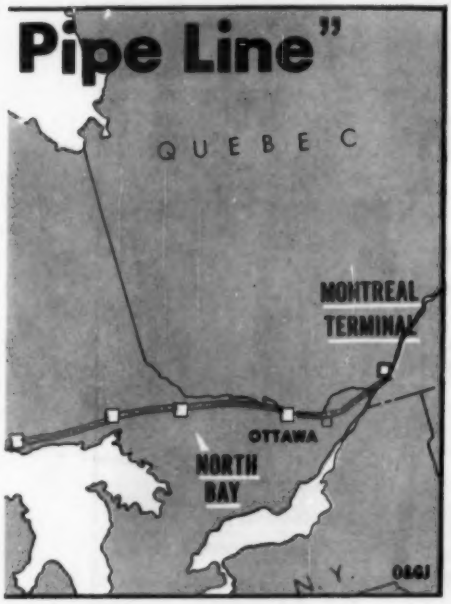
The competitive delivered price is based on tariffs of 22.2 cents to Superior, 39.6 to North Bay, and 48.1 to Montreal in the fourth year of operation.

This compares with Interprovincial Pipe Line Co. tariffs of 44 cents to Superior, 64 cents to Sarnia, and 72 cents to Toronto.

The Independent tariff figures, however, are based on throughput estimates which do not allow for seasonal variations in refinery demand below capacity, unforeseeable competition in serving areas considered, and variations from marketing forecasts.

Economics . . . The new proposal improves the economics of transmission with a larger-diameter pipeline.

It erases, backers say, the 25-cent



How Backers See Line's Year-to-Year Growth

(Barrels per day)

Year	Bellshill Lake-Superior Design Throughput	Superior-North Bay Design Throughput	North Bay-Montreal Design Throughput
1960	204,100	204,100	204,100
1961	258,600	228,600	228,600
1962	313,100	253,100	253,100
1963	367,500	277,500	277,500
1964	422,000	302,000	302,000
1965	476,500	326,500	326,500
1966	527,800	412,200	343,300
1967	579,000	440,100	360,600
1968	630,200	469,400	376,700
1969	681,400	498,000	393,500
1970	732,600	526,500	410,200

for Canada

disadvantage Canadian oil has had in previous studies.

Paul Clark, partner in Lehman Bros., New York investment bankers, testified that the line could be financed on the basis of long-term throughput guarantees for 260,000 bbl. per day at Montreal and 75,000 bbl. per day taken off at Superior.

Home Oil envisions the Independent Pipe Line as an industry project. It would be open to ownership by refiners, producers, and the public.

The project hinges on coordination with Interprovincial Pipe Line. It is characterized as an attempt to find a formula to enable Montreal refiners to use domestic crude.

The market . . . Demand for foreign crude in Montreal in 1960 was forecast earlier this year by Walter J. Levy, consultant, at 282,000 bbl. daily. He set product imports in 1960 at 32,000 bbl. daily.

Independent proposes to supply 70% of the Montreal demand initially, 80% in 1965, and all of it after that.

Product imports would be essential at first to offset the fuel-oil deficit caused by use of 35.5° API Alberta crudes instead of 25°-35° Venezuela and Middle East crude.

Interprovincial tie-in . . . Independent's study suggests that Interprovincial's line now exceeds its economic optimum capacity from Edmonton to Superior.

It suggests, however, that Interprovincial can handle more crude through its Superior-Sarnia and Sarnia-Toronto sections.

Independent feels its "express" line, with no injection or takeoff between Edmonton and Superior, would supplement and improve Interprovincial's service.

It would give Interprovincial crude at Superior to use the excess capacity of the Superior-Sarnia section. When Interprovincial's section to Toronto reaches capacity throughput, it could build a 200-mile lateral from Toronto to connect with the Independent line at North Bay, supplying all Toronto demand above 111,000 bbl. daily.

Independent proposes to deliver 29,400 bbl. daily to Interprovincial at Superior starting in 1961, increasing to 202,000 bbl. in 1970.

The Dutton-Williams Brothers report assumed exports to the U. S. Midwest of 80,000 bbl. per day in 1960, 100,000 in 1965, and 125,000 in 1970. It disregards potential markets in Chicago, Detroit, and Toledo.

Supply . . . To substantiate the adequacy of supply, Independent cites the Levy report showing surplus productive capacity of 370,000 bbl. per day for 1957, to increase to 500,000 bbl. per day by 1965.

The Calgary lateral would receive most of its stream from Britamoil pipeline. Britamoil would deliver oil from Drumheller, West Drumheller, Wayne, Fenn-Big Valley, Stettler, and smaller fields.

Throughput from Calgary would come from Harmattan, Harmattan East, Westward Ho, Sundre, and perhaps other fields, delivered to Calgary through Cremona pipeline.

A small volume would be injected directly at Bellshill Lake from Bellshill Lake field.

Deliveries to Edmonton are based on increased production from Pembina, Leduc, Redwater, Acheson, and Golden Spike.

The objection . . . J. R. White, president of Imperial Oil, Ltd., testifying after the pipeline proposal was made, told the commission Imperial is not considering use of Alberta crude at Montreal in the foreseeable future and is against the Independent line.

Imperial feels, he said, that:

. . . First step in expanding markets for Canadian crude is to build refineries in Ontario and saturate that market.

. . . Negotiation with the U. S. for exporting crude should be exhausted before assuming long-term financial commitments and trade restrictions involved in a long pipeline.

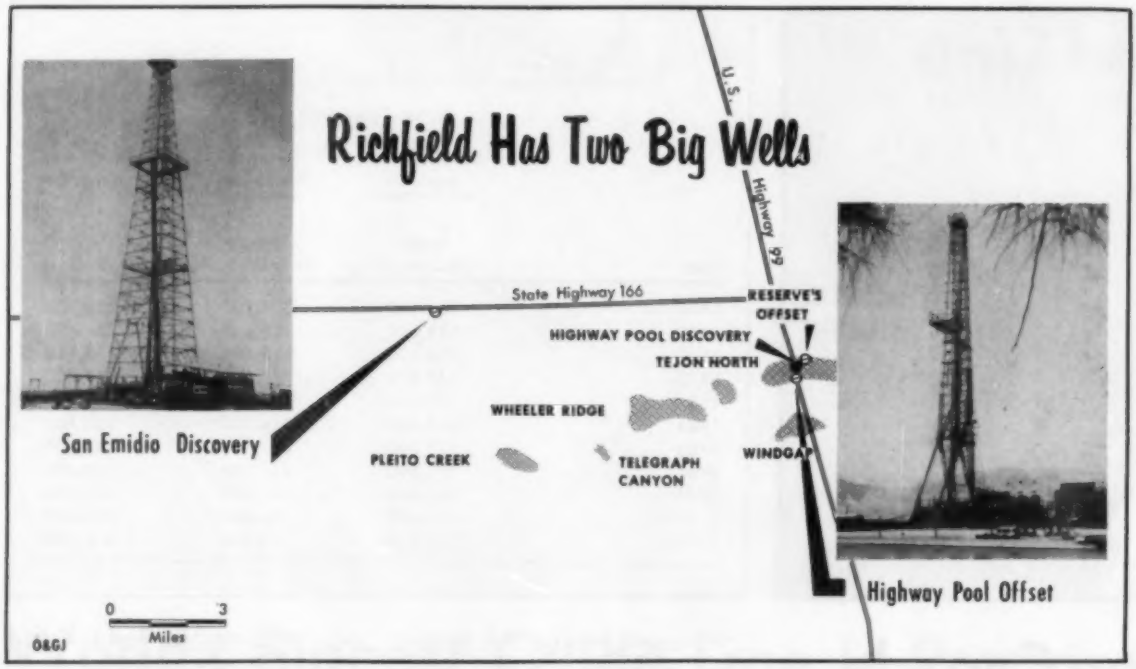
. . . The Montreal market is no permanent solution to the present oversupply.

. . . Consumers can be best protected by freedom of competition.

. . . The nation will benefit most from economic rather than "forced-draft" development of its resources.

White also said Imperial can't justify assuming of further heavy financial obligations for a new pipeline which it isn't convinced is economic.

The Borden Commission will report to Prime Minister Diefenbaker September 30. It will recommend what action, if any, the government should take to aid the oil industry.



Lengthy California Search Pays Off

TWENTY YEARS of seismic work, geological studies, and expensive wildcatting by itself and several other major companies on the San Emidio Nose structure in Kern County, California, has paid off for Richfield Oil Corp.

Richfield has completed 34-9 KCL "H" on San Emidio ranch property for what is being hailed as potentially the most significant discovery in California in recent years.

On the same day, Richfield also brought in the first offset to its Highway pool in the North Tejon field about 12 miles east of San Emidio.

Richfield's San Emidio discovery was brought in flowing at the rate of 2,520 bbl. daily of 29.8°-gravity crude from the Upper Miocene Reef Ridge sand at 11,452-11,560 ft. Shortly after being turned to the tanks, it was choked back to 14/64-in. flow and was making 265 bbl. daily. Total depth of the well is 11,970 ft.

Initial gas production was 740 M.c.f. daily with 100 lb. tubing pressure, with a 1½-in. choke. On the 14/64-in. choke, it was making only 60 M.c.f. daily.

The discovery is on a 8,500-acre Richfield lease with the Kern County Land Co. 10½ miles north of Wheeler Ridge field.

Search history . . . Events leading up to Richfield's success date back to 1934. At that time, Ohio Oil Co. located the structure on the San Emidio anticline which extends eastward across the southern San Joaquin Valley plains.

Ohio drilled a 7,500-ft. test on the structure in 1935 but failed to get through the Pliocene formations to the target Miocene zones. In 1936, The Texas Co. deepened the Ohio hole to 10,014 ft. but still failed to penetrate the Pliocene. In 1939, Shell Oil Co. moved into the area and drilled a 13,873-ft. wildcat which bottomed in the Upper Miocene, but the sands were too tight.

It wasn't until 1945 that Richfield tried its first wildcat, a 12,172-ft. dry hole on the east plunge of the anticlinal nose. It also found the Upper Miocene zone too tight.

In 1948, Continental Oil Co. went back into the old Ohio-Texaco dry hole and deepened it a second time to 10,414 ft., but also failed to get into the Miocene.

Continental then moved to a new location on the structure and finally drilled to the Miocene with a 13,000-ft. test in 1948. It also proved to be too tight and wouldn't produce despite promising shows.

Western Gulf Oil Co. was the next to try with a deep test to the Miocene on the north flank of the nose in 1951. But it was the same old story —sands too tight.

It wasn't until 1957 that Richfield decided to try again with a 14,471-ft. wildcat down structure from what eventually proved to be the discovery well. It also bottomed in unproducible Miocene sands with good shows.

Success at last . . . Richfield then moved upstructure to a location just off State Highway 166 on Kern County Land's 170,000-acre San Emidio ranch where the 20-year effort finally paid off. Richfield said it spent $1,200,000 on the three wells it drilled in the play.

Richfield is guardedly optimistic about the discovery. However, low dipping beds indicate the pay sand could be quite extensive and could eventually prove to be a major oil field. An extension test ½ mile northwest of the discovery has already been readied for immediate drilling by Richfield.

Little additional field-processing installations will be required because of the existing facilities at North Coles Levee and Wheeler Ridge fields in the general neighborhood. In addition, the discovery well is located only ¼ mile from the main Richfield San Joaquin Valley-Los Angeles refinery crude line.

The discovery touched off a lease

boom in the area. Other companies holding acreage in the region include Universal Consolidated Oil Co., Intex Oil Co., Continental Oil Co., Standard Oil Co. of California, Bandini Petroleum Co., Hamilton Dome Oil Co., Shell Oil Co., and Union Oil.

Highway pool offset . . . Two locations south of the Highway pool discovery, the offset was brought in flowing at an initial rate of 3,124 bbl. daily of 36.3°-gravity crude from perforations at 8,681-9,063 ft.

This offset is higher up structure than the discovery which was completed in the Lower Miocene at 9,165-9,557 ft.

Current production at the offset, 83-24 KCL G, is 334 bbl. daily of 36.3°-gravity crude through a 10/64-in. choke with 556 M.c.f. gas daily.

Richfield was getting ready to complete its second offset, a 9,963-ft. test two locations west of the discovery. Reserve Oil & Gas Co., discoverers of the main area of the North Tejon field, was nearing completion of a northeast offset to Richfield's pool discovery well.

Capital Spending Up in '57, Bank Study Shows

IN SPITE of the fact that last year was one of the most hectic in its recent history, the oil industry spent $11 billion increasing its operations in the free world.

Capital expenditures for oil on a world-wide basis in 1957 were up 12% over 1956. At the beginning of this year oil companies had $78 billion in capital at work supplying the world with oil. Slightly less than 61% of this amount is invested in the United States. The rest is in other countries of the world.

These figures are some of the highlights of the annual financial analysis of the oil industry prepared by Frederick G. Coqueron, oil analyst for Chase Manhattan Bank.

The base of Coqueron's report is a detailed study of the activities of 33 American oil companies, most of whom also operate abroad.

What's significant . . . Here are some of the facts revealed by the study:

. . . Free-world demand was 16,000,000 bbl. daily, a gain of 2.8% over 1956. U. S. demand increased only 0.4% but other countries showed a gain of 5.9% for the year.

. . . More than 200 American companies and individuals are involved in oil operations in more than 90 different countries of the world. This compares with only about 30 companies active abroad at the end of World War II.

Narrowing his sights to the U. S. industry alone, Coqueron found that oil's capital expenditures for 1957 amounted to $6.4 billion.

This compares with a yearly average of $4.6 billion for the 10-year period from 1948 through 1957. These figures include costs of drilling dry holes but not exploration expenses and lease rentals.

The study estimates that the U. S. oil industry generated $7 billion from its domestic operation. It paid dividends of $1.4 billion to its stockholders, leaving a cash income of $5.6 billion.

Estimated Financial Data, U. S. Petroleum Industry

(Millions of dollars)

CAPITAL EXPENDITURES

	1953	1954	1955	1956	1957
Production:					
Crude oil and natural gas*	3,400	3,700	4,050	4,375	4,400
Gasoline and cycling plants	125	100	50	100	125
Total	3,525	3,800	4,100	4,475	4,525
Transportation:					
Pipelines	325	275	190	175	275
Marine	100	50	35	50	70
Other	25	25	15	20	15
Total	450	350	240	245	360
Refineries and chemical plants	675	800	835	825	950
Marketing	325	350	375	450	475
Others	50	50	50	55	90
Total all departments	5,025	5,350	5,600	6,050	6,400

FIXED ASSETS—GROSS

	For year ending December 31				
	1953	1954	1955	1956	1957
Production:					
Crude oil and natural gas	18,625	21,500	23,100	25,000	27,000
Gasoline and cycling plants	775	800	825	1,000	1,100
Total	19,400	22,300	23,925	26,000	28,100
Transportation:					
Pipelines	2,700	2,950	3,050	3,175	3,400
Marine	1,050	1,025	1,000	1,000	1,000
Others	350	325	350	350	350
Total	4,100	4,300	4,400	4,525	4,750
Refineries and chemical plants	5,850	6,400	7,175	7,850	8,750
Marketing	3,700	4,000	4,300	4,700	5,100
Others	550	500	600	625	700
Total all departments	33,600	37,500	40,400	43,700	47,400

GROSS ASSETS EMPLOYED

	1953	1954	1955	1956	1957
Current assets	9,000	9,150	9,700	10,200	10,500
Property, plant and equipment	33,600	37,500	40,400	43,700	47,400
Other assets	600	550	600	600	600
Total	43,200	47,200	50,700	54,500	58,500

*Expenditures include cost of drilling dry holes and lease acquisitions but exclude exploration expenses and lease rentals.

Rigs Have Another Busy Year Abroad

IN CONTRAST to the sharp drilling slump in the U. S., rotary rigs are busier than ever in foreign areas.

A Journal survey shows that 851 rigs are running in the free world outside the U. S. and Canada. This is 10 rigs more than last summer's record level and a continuation of the upward trend which has been going on since 1949.

The total includes rotaries in use on wildcat and field development wells. It does not include rigs assigned to workovers and service wells.

While drilling abroad continues to climb, U. S. and Canadian activity is falling sharply. U. S. drilling is still far below last year's level, in spite of a slight pickup in June.

The 1,852 active rotaries in the U. S. at the start of summer (June 23) numbered 712 fewer than a year ago. In Canada, 154 rigs were running. This is 67 rigs below last year's figure.

Venezuela off . . . Activity in Venezuela has not contributed to the upward trend in foreign areas.

There are 93 rigs running in Venezuela, give or take changes in day-to-day-operations. This is a decline of 44 from a year ago, and a decrease of 16 from January 1.

Mene Grande is the busiest operator with 24 rigs. Creole has 14, Socony 11, and Shell 9. A dozen more companies are running from 1 to 7 rigs. Many of these are the newcomers to Lake Maracaibo. Contractors account for 43 of the total.

Eight companies in Colombia each have one rig on wildcat tests. Nine field wells are under way. There are two exploration wells drilling in Ecuador, and two field wells. The Chilian Government also divides its four rigs on Tierra del Fuego between exploration and development.

Drilling activity in the Caribbean is spotty. Rigs in some areas have been closed down for shipment or stacking. Union Oil suspended drilling in Costa Rica after drilling eight holes. It is continuing with geologic and geophysical work. Pan Jamaican moved its rig on Jamaica to Cuba.

Zapata Offshore Co. is drilling one of the most interesting wells in the area. Its Scorpion rig is making hole for a joint Gulf-Standard of California wildcat in Cay Sal bank in the Bahamas. The well is drilling ahead below 7,000 ft. It is projected to 15,000 ft., and the cost may run to $3 million (OGJ, Mar. 24, p. 108). The crews commute between the well site and quarters at Miami, Fla., 135 miles north.

Middle East . . . Iraq is the only major Middle East producing country with an intensive wildcatting program at present.

Of the nine rigs running in the country. Iraq Petroleum has four, Basrah Petroleum three, and Mosul Petroleum two.

Drilling & Exploration Co. is shipping two new rigs to Iraq this summer. In a newly completed deal with IPC, Drilexco will ship the first rig about August 1 and the second a month later.

Kuwait Oil has three rigs drilling in northeast Kuwait. Two development wells are going down in Burgan field, and one at Magaw-Ahmadi.

No wildcatting is currently under way in Saudi Arabia. Two development wells are drilling on the main-

How Many Rigs Are Running and Where

Country—	July '58	July '57	Mar. '56
North America:			
Bahamas	1	...	...
British Honduras	2	...	1
Costa Rica	...	1	1
Cuba	4	7	12
Guatemala	1	1	...
Jamaica	...	1	...
Mexico	110	96	88
Nicaragua	...	1	...
Panama	1	...	...
Total	119	107	102
South America:			
Argentina	65	58	48
Barbados	...	...	1
Bolivia	16	10	8
Brazil	43	20	28
Chile	4	4	5
Colombia	17	20	22
Ecuador	4	7	10
Peru	13	16	21
Trinidad	27	28	26
Venezuela	93	137	100
(Eastern)	(51)	(68)	(60)
(Western)	(42)	(69)	(40)
Total	282	300	269
Western Europe:			
Austria	32	32	32
Denmark	1	1	...
France	50	29	29
West Germany	140	138	106
Greece	...	1	3
Italy	36	34	34
Netherlands	3	9	8
Portugal	1	2	2
Spain	3	3	3
United Kingdom	6	8	9
Total	272	257	226
Africa:			
Algeria	37	24	14
Angola	2	2	1
British Somaliland	1	1	1
Egypt	4	2	8
Ethiopia	...	...	1
Fr. Equatorial Africa	10	10	9
Ghana	...	1	...
Madagascar	3	2	...
Morocco	2	4	8
Mozambique	1	1	...
Nigeria	8	6	6
Somalia	2	2	...
Tanganyika	1	1	1
Tunisia	2	2	5
Total	73	58	54
Middle East:			
Bahrain	0	1	3
Iran	8	8	5
Iraq	9	5	14
Israel	6	12	12
Jordan	1	1	...
Kuwait	6	5	3
Neutral Zone	5	6	2
Qatar	1	1	2
Saudi Arabia	3	4	4
Southern Arabia	4	4	4
Syria	2	1	...
Turkey	5	5	5
Total	50	53	54
Asia-Pacific:			
Australia	4	5	12
British Borneo	2	3	3
Burma	3	2	2
India	5	6	6
Indonesia	16	21	29
Japan	15	15	15
New Guinea (incl. Papua)	3	4	4
Pakistan	6	8	5
Philippines	1	2	...
Total	55	66	76
GRAND TOTAL	851	841	781

land, and one offshore field well is under way at Safaniya. In addition, two rigs are drilling gas injection wells in the Ain Dar area of Ghawar field.

Iranian Oil Exploration & Producing Co. has six rigs in operation. A seventh was destroyed by the fire at Ahwaz 6 (OGJ, June 9, p. 82). Four are running at Agha Jari and one at Gach Saran. A wildcat is drilling at Kuh-i-Binak, north of Kharg Island on the Persian Gulf Coast.

Bahrain Petroleum Co. has reached a record daily production of 40,000 bbl. with no rigs at all on development drilling. The increase has been achieved by working over old wells.

Africa gains . . . Drilling in Africa has been whetted by the development of scattered production. Output outside of Egypt has risen from 4,500 bbl. daily to over 20,000 bbl. daily in the past year. It is growing monthly.

Along with the big programs in Algeria, Libya, and Nigeria, extensive work is under way in many coastal regions of East and West Africa. Among the more remotely located rigs is a Royal Dutch-Shell and British Petroleum rig drilling ahead at 3,500 ft. at Mandawa 1 in Tanganyika. On the West Coast, a joint BP-French company is at 4,000 ft. in a well near Casamance in Senegal.

—— *Industry* briefs

Merger of McRae Oil & Gas Corp. into Sunset International Petroleum Corp. has been approved by stockholders of both companies. Under the merger agreement each share of McRae common outstanding will be converted into 0.77981 of a share of Sunset common. The merger means that Sunset now has net crude-oil reserves of more than 20 million barrels and gas reserves of more than 27 billion cubic feet. It has 4,000 bbl. per day of crude production and about 8 million cubic feet daily of gas production.

Imperial Oil, Ltd., has abandoned its wildcat near Summerside on Prince Edward Island at 9,714 ft., and is moving its rig to a new site in the Porthill area of the island for another test. The new well will be 1 mile south of Porthill station.

The Colorado Oil and Gas Conservation Commission has approved a water-injection plan for the Badger Creek field in Adams County. The pressure-maintenance program for the D sand reservoir was proposed by Sinclair Oil & Gas Co. and Forest Oil Corp. Badger Creek is one of four fields 8 miles east of Brush, Colo., to be included in a water-flood system under construction.

Purchase of Canadian Atlantic Oil Co., Ltd., by Pacific Petroleums, Ltd., has been approved by Canadian Atlantic's directors. Canadian Atlantic, which has no relation to Atlantic Refining Co., Philadelphia, will call a special shareholders' meeting soon to vote on the proposed merger. Officials of the two companies said the purchase would be on the basis of one share of Pacific Petroleums for three shares of Canadian Atlantic.

Humble Oil & Refining Co. has obtained fee title to about 125,000 acres of oil-rich lands in South Louisiana by acquiring assets of Louisiana Furs Corp.

Seven oil or gas fields are located at least partly on the properties in Vermilion Parish. They include Pecan Island, Fresh-water Bayou, North Fresh-water Bayou, and North Pecan Island fields, and portions of East White Lake, Live Oak, and Southwest Esther fields. Details of the transaction were not disclosed.

Humble and several other oil and gas producers are among the operators on the acreage. Humble announced it also has purchased more than 85% of the royalties held by others on portions of the acreage.

Rich-Gas Flood Works

. . . on first test in Texas' Seeligson field. Humble says core test shows reservoir is swept almost clean of oil.

HUMBLE OIL & Refining Co.'s enriched-gas-drive recovery method is looking good in its first field trial in South Texas' big Seeligson field.

The method, one of three basic approaches to miscible-phase recovery which oil operators now are pushing through the proving stage, is being tested under exacting control conditions in Humble's wholly owned Zone 20-B-07 under its big King ranch lease.

Injecting about a 50-50 mixture of propane and separator gas, Humble has hiked field pressure about 300 psi. Gas-oil ratios of the producing wells are coming down.

These are good omens but the clincher is the data Humble has gleaned from an observation well just 100 ft. away from one of the input wells. The observation well was drilled, cored, and drill-stem tested about 9 months after injection was kicked off. Tests showed that the reservoir in the vicinity of this well had been swept almost completely clean of oil.

Results have encouraged Humble to ask the Texas Railroad Commission for a reservoir allowable of 1,000-bbl. daily, a little more than double the present allowable, so that it can evaluate the drive's performance more fully.

There are other things, Humble informed the commission, that it must know before it can class the experiment as an unqualified success. More allowable and more time are needed before the company can determine whether:

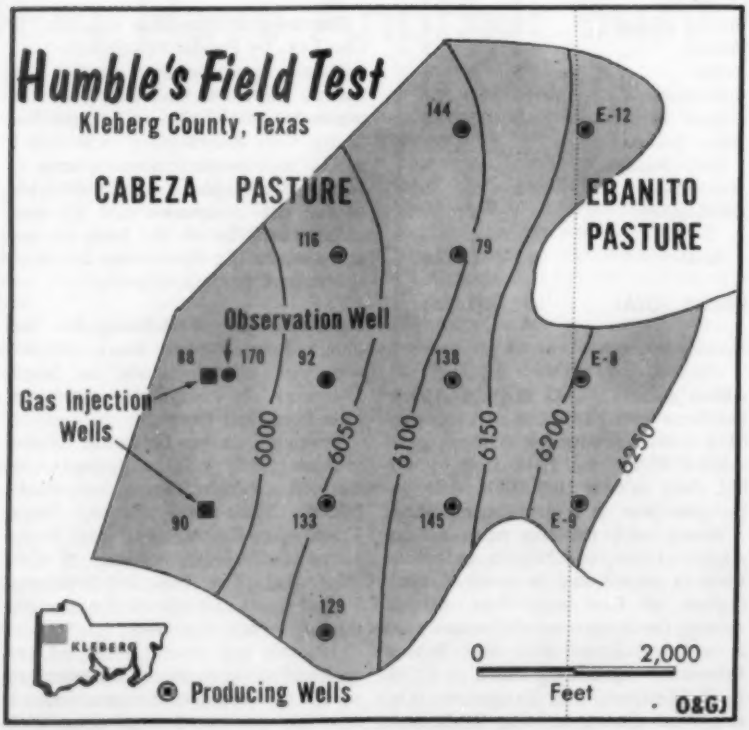
. . . **Gravity segregation** will occur at the "flood" front or interface.

. . . **Pattern efficiency** will be good.

. . . **A high conformance** to the condition of the swept portion of the pool in the area of the observation well can be expected of the reservoir as a whole.

Favorable answers to these questions, Humble feels, "could greatly change the expectations for the domestic production of petroleum."

They could mean that industry has found a tool with which to produce essentially all the oil in a reservoir.



NEAR TOTAL RECOVERY in the area of the observation well is proof Humble's enriched-gas flood in Kleberg County is getting excellent results.

Progress . . . Humble went to the commission for a permit to launch the experiment on July 31, 1956, and got it August 20, 1956.

It immediately set to work to complete two injection wells on the west side of the field, to contract for propane from the Seeligson Unit plant, and to install injection facilities.

Actual injection started March 19, 1957. The miscible drive will use an end-to-end sweep from west to east.

Since the start, Humble has injected about 1.34 billion cu. ft. of enriched gas.

Pressure at the start of injection averaged 2,360 psi. over the field and gas-oil ratios were climbing.

Field pressure now has been boosted to 2,660 psi., while GOR's are coming back down. Humble says this decrease in average reservoir gas-oil ratio is not due to transfer of allowables from high-ratio wells but to redissolving of free gas in the oil column. The latter in turn is due to the increased reservoir pressure and the formation of an oil bank due to the displacement process.

The key proof . . . Final proof that the drive was sweeping oil efficiently was furnished by the core-test of the observation well.

Just prior to the start of injection, Humble potentialed its K. R. Seeligson C-88T on the west side of the field. The well produced 122 bbl. of 44°-gravity oil with a GOR of 12,197:1. This proved oil saturation in the west end of the field.

The C-88T then was converted into an enriched-gas input well, as was the C-90 to the south, and its allowable transferred to other producers.

The observation well, the C-170, was drilled 9 months later in December 1957 just 100 ft. east toward the center of the field from the C-88 and structurally lower than that well. Reservoir cores were pulled and drill-stem tests run from 6,102-20 and from 6,128-37 ft.

No oil was recovered in either test —only gas. Core analyses showed zero oil saturation in the more permeable portions of the reservoir rock in the well. Further, residual oil saturation in the tighter rock was very low.

This is a dramatic exhibition and the most solid proof yet of the highly efficient sweep of the miscible drive wherever it reaches.

The field and the project . . . The Zone 20-B-07 pool is nearly ideal for Humble's purposes.

It is a monoclinal, lenticular sand development on the eastern flank of the big Seeligson structure. It is completely closed—bounded on the west

by sealing faults, on the north and south by strand lines, and by a sand pinchout on the east.

The field produced naturally via a solution-gas drive—the least efficient of the natural forms of production energy.

Humble selected this pool for its test because:

. . . **Its small size,** 565 acres, will permit quicker evaluation of the process.

. . . **Good geologic control** is available.

. . . **Sand development** is fairly uniform.

. . . **Reservoir configuration** also is relatively uniform.

. . . **Pool development** is complete, with 12 producing wells including the observation well.

. . . **Low primary recovery** was expected.

. . . **Field was in flush stage** of production and therefore didn't have excessively high gas saturations in the oil zone.

. . . **Entire pool** is owned by Humble and there is only one royalty owner.

Stumbling blocks . . . The Humble test, as Humble points out, still has several possible stumbling blocks to hurdle before it can prove definitely that miscible recovery, specifically the condensing-gas drive, actually has the tremendous potential it would appear to have from test results so far.

Some companies feel that gravity segregation will occur in a miscible drive after the front moves some distance away from input wells. This means simply that the gas and light hydrocarbons will move upward and thus fail to sweep out oil in the lower portion of a reservoir. Other companies are fairly certain that this will not happen. Humble should be able to find out.

Likewise, some operators are certain that miscible drives alone, unless followed by water flooding, will have a poor areal sweep efficiency in that the drive will miss large areas of the reservoir rock. Some fear that gas fingering and coning will occur to lower recovery.

Here, too, Humble, with the close degree of control it is exercising over the small, closed reservoir, likely will be able to gather data which will dispell or confirm these fears.

If none of these adverse effects take place in this small reservoir, Humble will have gone a long way toward helping prove what many in the industry have suspected and predicted—that miscible-phase techniques are going to recover millions of barrels of domestic oil that now are unproducible.

watching WASHINGTON

Bertram F. Linz

• NLRB authority goes offshore

THE OIL INDUSTRY has gone to sea, but even there it won't escape the National Labor Relations Board.

The NLRB made this clear recently when it put on hip boots and waded into the Gulf of Mexico after the General Marine Corp.

General Marine works out of Louisiana, servicing drilling operations in the Outer Continental Shelf. Its workers complained that the company was interfering with their unionization efforts.

The company argued that the NLRB had no standing in commerce between a state and an outside point under sole control of the federal Government.

An NLRB examiner tossed that argument out and the full board backed him up.

The board held that it didn't require any change in its law to assume authority offshore. The Outer Continental Shelf Lands Act extended NLRB jurisdiction to commerce between states and points on the Continental Shelf, it ruled.

• Senators shoot holes in import program

OIL-STATE SENATORS have outlined the angles from which they will attack the voluntary import program when the Senate takes up the foreign trade bill.

And a score of senators already have said they will support quota controls along the line first proposed by Rep. Frank Ikard (D-Tex.).

The main charge is that the present plan is inadequate and ineffective to bring imports down to their 1954 ratio. And here, say the senators, is why:

Success or failure depends on the importing companies, not the Government.

It places the Government in the position of pleading for support of a program vital to our national defense.

It is already under court attack and may fall as a result.

It does not cover the bulk of product imports, which in many cases supplant much greater volumes of crude oil.

It did not even start out to hold imports to their 1954 ratio, as urged by the cabinet fuels committee in 1955.

"Would we expect Brazil to shut down its coffee industry and use imported coffee?" asked Sen. Russell B. Long (D-La.). "Yet that is what the U. S. Government is asking the domestic industry to do."

• What the freight tax repeal means

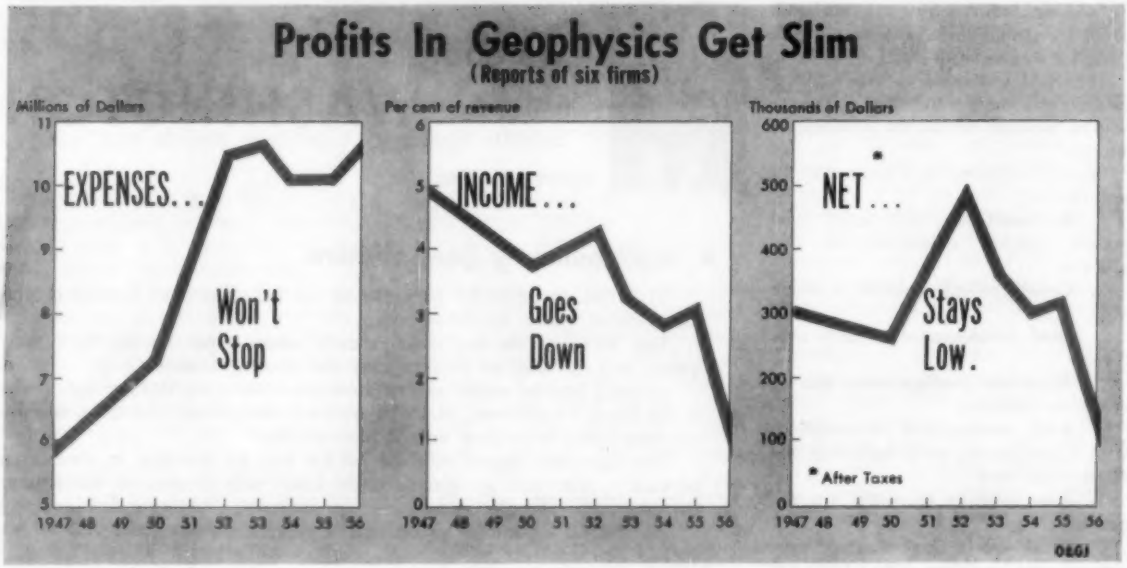
REPEAL of the freight taxes will save the oil industry a substantial sum of money. And the industry may need the money to cover rate advances which are likely in the near future.

The wiping out of the 4½% tax on pipeline movement will free more than $35 million a year. Repeal of the 3% railroad and truck freight tax will add more to that sum—around $8 million on rail shipments alone.

The industry still is a pretty good customer of the railroads despite the growth of pipeline and truck movement. Last year, it paid nearly $280 million in freight.

Crude-oil movement, which topped 1 million barrels a day in 1942 when our tankers were blasted out of the water by the Germans, was down to 5,300 carloads last year.

Products shipments, however, ran close to 2.25 million carloads in 1957.



Firms See Higher Fees As Solution

• Geophysical contractors have been caught in grip of rising costs and declining income for 5 years. Result is some are going out of business, and unless trend is changed others say they will follow.

GEOPHYSICAL companies are fighting hard to stay in business.

Some are surveying the foreign field. Some think they must find a way to map strat traps to stay in business. Others are making equipment or looking for additional opportunities in other fields of industry.

Reason for the uneasiness is simple: Profits for the most fortunate firms doing contract geophysical work are down sharply. Many are losing money. And they all see no lifesaver appearing in the short-term future.

The immediate answer, all agree, is an increase in their fees which will net geophysical contractors a reasonable profit and offset rising costs they are unable to control.

Alarmed by the trend, 13 of the leading geophysical companies employed the accounting firm of Price-Waterhouse & Co. to make a detailed analysis of their financial statements.

The study showed the 13 firms had an average net income in 1947 of 4.9% of gross revenue. From this high, income of the firms dropped to average net losses starting in 1954. The analysis, however, studied separately the statements of what they considered the more typical companies and found these averaged a net income in 1956 of 1.5% of gross revenue. The picture grew no brighter in 1957.

Any way the profits cake is cut, the slices are smaller.

Familiar story . . . Hard times, actually are not new for the contract geophysical companies.

This segment of the oil industry for 5 years has been caught in a familiar squeeze: Increased operating costs on one side and a ceiling on current income on the other.

Competition for the dwindling amount of domestic business has been so keen it's impossible to raise prices. Geophysical costs, like all other operating costs, continue to spiral at a dizzy pace.

The result is that the average contract geophysical company today is looking at a net income after taxes of 1% or less of its gross annual revenue for domestic operations.

This means many contractors:

. . . Cannot afford research to better their products.

. . . Can't provide new equipment for their clients in many instances.

. . . Are unable to attract capable young scientists into the field.

The number of contractors is dwindling rapidly. In fact, one leading Houston geophysicist says if the current rate of attrition continues, there will be no contract geophysical industry in 2 years.

The recent cutbacks in domestic geophysical activity have hit the contractor the hardest. In the past 3 years the number of geophysical crews operating in the U. S. has dwindled from a high of 628 to 491, a drop of 22%.

On the face of it, this doesn't sound so alarming, but most of the crews eliminated have been contract crews. This means that in the past 2 years the number of contract crews has been cut 38%.

No letup . . . This domestic trend is continuing its downward slump in the first 6 months of 1958.

This trend is due largely to a general cutback in their exploration budgets by oil companies. When it comes time to use the reduced exploration budget, it's easy to eliminate a geophysical crew, particularly a contract crew.

The same line of reasoning applies to drilling rigs and accounts for the present drilling slump too.

One leading geophysicist put the industry plight this way: "The geophysical contractors appear to be hurting from the situation which is plaguing

the domestic oil industry as a whole. That situation is found in the rising costs of finding and producing oil in the U. S., which have far outdistanced oil price increases."

The Price-Waterhouse study showed how geophysical overhead has risen rapidly during the last 5 years.

Salaries . . . A basic field crew of 12 men in 1952 cost $4,117 monthly in salaries.

This rose to $4,944 in 1956, an increase of 20%, and the trend is still upward.

Wage scales show clearly why the geophysical contracting industry can no longer buy the best available technical help, even though its salary scales are rising.

The average monthly wage for party chief is $685, and the work week is 50 hours. Pay for computers and observers is $475 monthly, for shooters, $365, surveyors $410, drillers $420, and helpers $290.

At the same time the oil industry pays up to $600 for an inexperienced Ph.D., and these men work a 40-hour week.

Today's mad scramble for the physicist and scientist for atomic energy work, guided missiles, and the electronics field puts the contract geophysical industry out in right field without a glove. It can no longer pay a premium and get the men it wants.

Other expenses besides salaries also have been on the rise. The cost of equipping a standard field crew with six vehicles and drilling tools has jumped 38% since 1950.

In the 1952-56 period, direct costs of the contractor increased 22.7%. But what happened to the price the contractor charged for his geophysical prospecting services? Oil companies in the same period paid only 2.2% more per basic field crew in 1956 than they did in 1952.

Abuses . . . Another contribution to high costs is the interest geophysical firms must pay to carry substantial amounts of "accounts receivable." True, this is a fairly common practice in the oil business, but it puts an added burden on the small contractor.

In some cases these "accounts receivable" totaled $100,000 to $300,000 for the 13 companies surveyed. They represent extra costs charged to clients who actually will reimburse the contractor. The accounts may cover the cost of dynamite or extra services.

Reimbursable costs, in particular, are a substantial item in West Texas, where the monthly bill for a single crew may exceed $25,000. Frequently the contractor must borrow money at 5 to 6% to cover these. The client simply reimburses him for the sum, not the interest.

Conceivably a contractor at work in West Texas with three or four crews would be paying interest at 6% on $100,000 over a year's operation. This interest amounts to $4,500 that the client should pay for but usually won't. One contractor stated that he was threatened with the loss of the contract if he tried to recover his interest.

Net profits slump . . . The ratio of profit before income tax to gross revenue has declined consistently since 1952 for the companies analyzed.

A low point was 1956, when it ranged from 1.1 to 3.5%, depending upon the groupings. After income tax, the ratio between net income and gross revenue was even gloomier, ranging from a loss to a maximum net income amounting to only 1.5% of the gross revenue.

Comparison of net income to the combined net worth for the companies surveyed, too, shows an alarming drop, starting with 11.9% in 1953 and decreasing to 3.3% in 1956.

This decline is continuing. Of seven major geophysical contractors contacted by The Journal, four reported 1957 profits ranging from 1.12 to 3.16% of net worth. Three reported losses for 1957. And one of those showing a profit in 1957 is operating at a loss this year.

What is the outlook? . . . Is the contract geophysical company at the end of the rope?

The answer depends upon a number of factors and in the final analysis on the enterprise of the individual company. Consensus of industry leaders is that relief from their present predicament can come from:

. . . Larger contract fees. One company official puts this argument thus: The contract geophysical industry cannot meet the changing exploration trends unless the contract fee is adequate to cover the cost of competent personnel and better instrumentation. He estimates a 20% increase in contract rates is needed.

. . . Going abroad. This area is proving attractive, but even here it costs a quarter of a million dollars to outfit and equip a seismic crew and put it on foreign shores. Operating costs exceed $50,000 a month.

In addition, the oil companies prefer to hire contractors who have had previous foreign experience. This narrows the field to a handful of seismic companies who have been in the foreign game for many years. A newcomer has difficulty getting his foot in the door.

. . . New techniques. One real hope of the contract geophysical industry lies in its ability to meet changing exploration trends.

Already there are indications that seismic work can actually map strat traps (OGJ, March 17, p. 144). At the present time these techniques are still in early stages of development, and it may be 5 or 10 years before the industry reaps benefits.

. . . Packaging the service more expertly. One geophysicist observes that it's possible a significantly large part of the geophysical work done in the United States today could be improved upon.

He gives two reasons: Lack of full analysis of the geophysical problem by the contractor and oil company before work is started; and failure to carry the work forward in a series of planned steps that will best accomplish the client company's objectives.

This critic suggests that the oil company and the geophysical contractor together should closely examine the geophysical work before undertaking a project.

He adds: "Contract companies do not simply furnish shooting crews nowadays. The contractor is equipped and able to furnish a service fully professional in every detail.

"Ideally, the geophysical party should work with the full confidence and cooperation of the client company in performing a complete service, in doing a full job rather than in working on isolated details of a problem of which it is not given comprehensive knowledge."

Adequate planning and programming can allow the contractor to package his services for top efficiency, thus eliminating wasted effort and reducing costs to both the client and himself.

Geophysical contractors agree, however, the immediate outlook depends on their getting larger fees for their services. Costs have so far outstripped income that even a stepped-up volume of business and greater efficiencies might not solve the profit problem.

They believe geophysics have become an integral part of the exploration picture in the oil industry and it should play a valuable role in the future.

But the contractors say if they are to continue giving dependable service with expert crews and up-to-date equipment, they must have fees which will cover their costs and return a reasonable profit. They claim this is fast becoming impossible under present income.

Import Plan Attacked

. . . in Congress and the courts. Eastern States case may be appealed. New quotas are set for West Coast importers.

CONGRESS, the Government and the courts are wrestling with the many-sided imports problem this week.

The voluntary program is under attack in Congress and the courts, while the Government is watching carefully the industry's reaction to new quotas for the West Coast.

Eastern States Petroleum & Chemical Corp. and the Government tangled in the District of Columbia federal court, and the Government won the first round.

Eastern States is attacking the legality of the voluntary import program and the executive order which deprived the company of a 12-million-gallon jet fuel contract.

The court refused the company's plea for a preliminary injunction which would have revived the contract. But Eastern States quickly prepared to appeal.

Eastern States was denied the contract for failure to comply with the import quotas.

The decision did not go into the merits of the case. This will come on appeal. It was at the company's suggestion that the Government moved successfully for dismissal of the injunction petition.

In attacking the executive order, Eastern States contended the President has no legal authority to set up the voluntary program, but a government attorney replied the President's action was proper under both the Reciprocal Trade Act and the Buy American Act.

District Judge Alexander Holtzhoff ruled, in effect, that the Government has full power to decide what it will or will not buy and can turn down bids not in the public interest. He pointed out the executive order doesn't prevent anyone from importing as much oil as he wants as long as he doesn't sell it to the Government.

West Coast imports . . . The new District 5 import program got more than passing interest from the industry. Some oil men read into it a sign that the Government foresees some recovery from the depressed conditions of the last few months.

This was indicated by the cabinet committee's failure to cut the 221,100-bbl.-daily quota set down last January. That figure will remain the over-all level through November.

All the cabinet committee did was to cut back present importers 12,900 bbl. daily to make room for eight newcomers. The 6.29% cut will be spread over 5 months.

Industry circles originally expected West Coast imports might be cut back to as low as 150,000 to 175,000 bbl. daily. But the cabinet committee, in ordering the smaller cut, explained that production by independents currently exceeds 95% of capacity.

Action in Congress . . . The final session of hearings on the foreign-trade act by the Senate finance committee brought demands for mandatory controls last week from such influential persons as Gov. Raymond Gary of Oklahoma and Ernest O. Thompson of the Texas Railroad Commission as well as spokesmen for the independent producers.

The domestic producers backed the Long amendment, based on the Ikard bill which the House ways and means committee had failed to approve. It would put quota controls on both crude and products and provide for the sale of import certificates to the highest bidders. The President, further, could assign quotas to foreign sources to avoid a monopoly of imports by the Middle East.

Elusive definition . . . The Interior Department, meanwhile, is finding it difficult to define unfinished oils. It is a question of end use, in large part. Residual, for instance, may be imported for use as fuel. Or it may be brought in for further processing.

Capt. M. V. Carson, imports administrator, hopes a suitable definition will be written soon. But it may prove almost as hard to write workable regulations for a voluntary control program on unfinished oils.

District 5 Import Allocations

(Thousands of barrels)

Company—	Allocation					
	Present	July 1	Aug. 1	Sept. 1	Oct. 1	Nov. 1
New Importers						
Bankline Oil	....	2.3	2.3	2.3	2.3	2.3
Century Oil	....	....	....	1.5	1.5	1.5
Envoy Petroleum	....	....	....	1.2	1.2	1.2
Golden Eagle Ref.	....	....	2.3	2.3	2.3	2.3
Manespo Ref.	....	....	....	1.4	1.4	1.4
Palomar Oil & Ref.	....	....	....	....	....	0.5
Rothschild Oil	....	2.7	2.7	2.7	2.7	2.7
Socal Oil & Ref.	....	....	....	....	1.0	1.0
Old Importers						
Caminol Co.	3.0	2.9	2.9	2.8	2.8	2.8
Douglas Oil	4.7	4.6	4.5	4.4	4.4	4.4
Edgington Oil Ref.	3.0	2.9	2.9	2.8	2.8	2.8
Fletcher Oil	5.5	5.3	5.3	5.2	5.2	5.2
General Petroleum	25.5	24.8	24.5	24.1	24.0	23.9
Hancock Oil	3.0	4.0	4.0	4.0	4.0	4.0
Macmillan Petr.	2.5	2.4	2.4	2.3	2.3	2.3
Mohawk Petr.	3.1	3.0	3.0	2.9	2.9	2.9
Richfield Oil	9.1	8.9	8.8	8.6	8.5	8.5
Shell Oil	32.5	31.6	31.3	30.7	30.5	30.4
Standard of Calif.	29.7	28.9	28.5	28.0	27.9	27.8
Sunland Ref.	2.5	2.4	2.4	2.3	2.3	2.3
The Texas Co.	20.6	20.0	19.8	19.4	19.4	19.3
Tidewater Oil	37.9	36.9	36.5	35.8	35.6	35.5
Union of Calif.	12.4	12.1	11.9	11.7	11.6	11.6
U. S. Oil & Ref.	8.0	7.8	7.7	7.6	7.5	7.5
Wilshire Oil	18.1	17.6	17.4	17.1	17.0	17.0
Totals	**221.1**	**221.1**	**221.1**	**221.1**	**221.1**	**221.1**

Pipeline Contracts Let

NATURAL GAS Pipeline Co. of America has awarded contracts for over 500 miles of main-line looping between Fritch, Tex., and Joliet, Ill.

The $81,840,000-program includes 493 miles of 36-in. and 21 miles of 26-in. Construction is to get under way August 1 with completion scheduled for January 1 in time to increase deliveries at least 100,000 M.c.f. daily this winter to the Chicago area.

Here are the contractors and their sections:

... **R. H. Fulton & Co.,** Schedules 1 and 2, 21 miles of 26-in. and 101.8 miles of 36-in. between Fritch and the Kansas line, and 104.91 miles of 36-in. in Kansas.

... **Williams Brothers,** Schedules 3A, 3B, and 4, 106 miles of 36-in. in Kansas and Nebraska, terminating near Emerson, Iowa, and 99 miles of 36-in. from there to Harper, Iowa.

... **Contracting Materials Co.,** Chicago, Schedule 5, 81.69 miles of 36-in. from Harper to Joliet.

Tidelands Decision

delayed until Supreme Court returns to work in October.

THE U. S. Supreme Court left some highly important oil and gas cases hanging fire when it adjourned in late June.

When the court returns October 6, the first major issue to come before it will be that of the gulf states' boundaries.

It also will have before it a number of natural gas cases, including the important Memphis decision that a pipeline must obtain the consent of all customers to an increase in rates before applying to the Federal Power Commission for the increase.

Also awaiting decision is the Government's appeal from an adverse decision in three suits charging oil pipelines with evasion of the 7% maximum dividend provided for in the 1940 Elkins Act decree.

The gulf boundary suit is the last of a series of cases brought by the Government over the past 13 years to fix the limits beyond which the coastal states hold no title to the oil or other resources underlying the Continental Shelf.

The enactment in 1953 of two "tidelands" bills, which overturned earlier decisions giving the U. S. "paramount rights" beyond the low-water mark, led to the filing of suits to invalidate claims of the gulf states to a 3-league boundary.

The present suit first named Louisiana only. It was broadened to cover all the gulf states by a Supreme Court order last year.

Three Deep Wells Go Deeper

THREE deep-drilling wells in Texas and Oklahoma continued breaking records last week at depths of greater than 4 miles, but a fourth deep well bottomed out at 19,020 ft.

Here is the picture:

... **Phillips Petroleum Co.'s** 1-EE University in Pecos County, Texas, still searched for the base Ellenburger formation. The well, 8 miles east of Fort Stockton, drilled to 23,647 ft., by far the deepest any well has ever gone. The bit was still in the Simpson formation. The Ellenburger is expected below 24,000 ft.

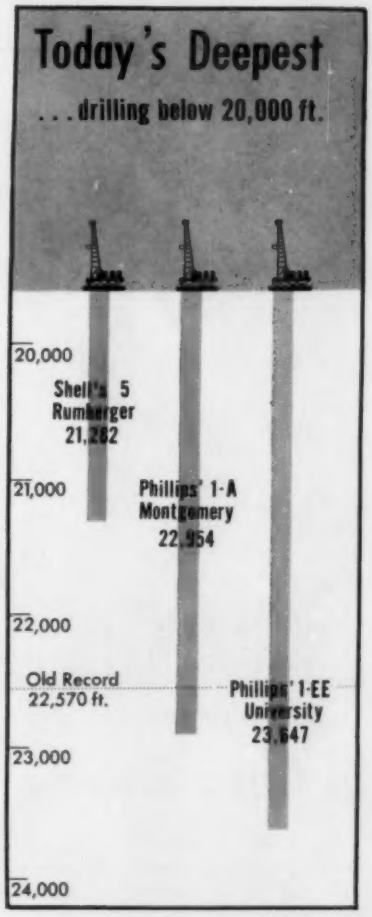
... **Phillips' 1-A Montgomery,** 30 miles to the southwest, joined the 1-EE University in beating the old world depth mark of 22,570 ft., set in 1956 in South Louisiana. The 1-A Montgomery went to 22,954 ft. after topping the Ellenburger objective at 22,598 ft.

Phillips plans to continue drilling to 23,000 ft., set casing to that depth, and then drill under the casing another 400 ft. to test in the open hole. So far there have been no shows in the Ellenburger, although the operators cannot be certain of what they have because samples from great depth "are pretty much washed out."

... **Phillips' 1-A Harral,** 11 miles southeast of the 1-EE University, was bottomed out at 19,020 ft. in the Wolfcamp. Casing of 5½ in. was set to total depth. Earlier drill-stem tests had some shows, and production tests will be run at various points. The well failed to reach the Ellenburger objective.

... **Shell Oil Co.'s 5 Rumberger** in the Elk City, Okla., field drilled below 21,281 ft. last week, far below the former Oklahoma depth record of 20,426 ft.

Shell geologists are uncertain whether they have reached the Springer objective or are still in the Morrow. Drilling has slowed down to as little as 10 ft. a day because of the hard formation, but the operation otherwise is normal. Helmerich & Payne is the drilling contractor.



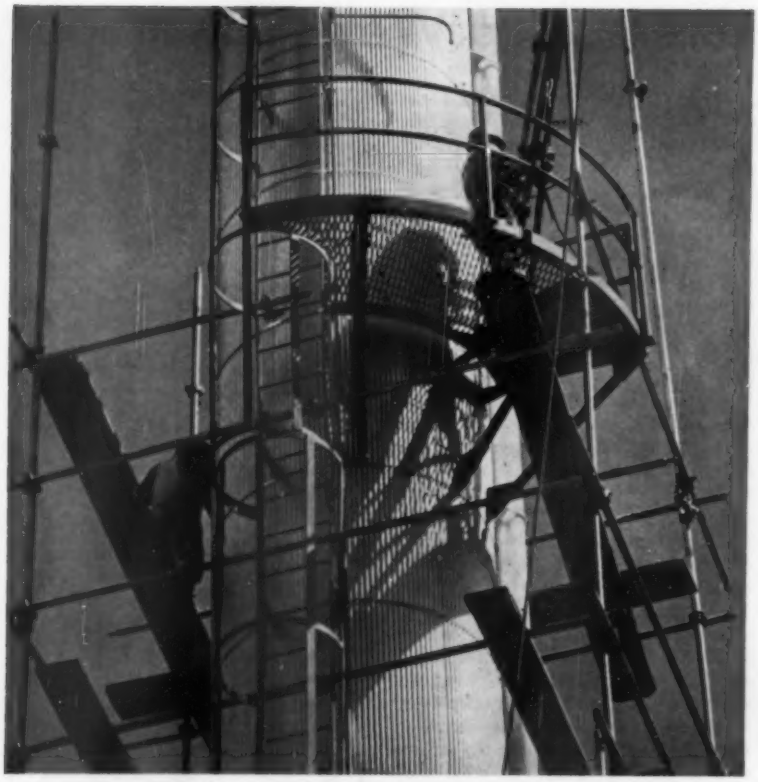
Date for Midwest Case May Be Set Soon

A FEDERAL POWER COMMISSION decision in the many-angled fight for the big Midwest gas market may come by November 1.

The big Midwest case is being pondered by an FPC examiner. He is expected to send his report and recommendations along to the full commission within 2 months.

The FPC's findings may prove to be nothing more than a springboard to get the case into the courts, however. That could mean a delay of another couple of years in getting gas service into the last big untapped market. One angle in the fight already is slated for the courts. The Justice Department secured an indictment April 30 against three of the four major pipeline companies on antitrust charges.

The government's grand jury investigation in Milwaukee resulted in charges that American Natural Gas Co., Northern Natural Gas Co., and Peoples Gas Light & Coke Co. and one official of each had combined illegally to freeze Midwestern Gas Transmission Co. out of the Wisconsin-Minnesota-Michigan-Illinois area for which the companies are fighting.



SCAFFOLDING comes down and new refinery is ready. It means . . .

El Paso Ready for Competition

EL PASO Natural Gas Products Co. is becoming a formidable refining and marketing competitor in the Southwest.

The company's ultramodern refinery at Odessa, Tex., will go into full operation this week, putting El Paso in the forefront of any octane race which might develop in its marketing area.

Furthermore, El Paso is ready with a new 248-mile, 6-in. products pipeline from Odessa to El Paso, Tex., to move the refinery's output closer to the company's growing retail outlets.

It has acquired some 284 service stations and intends to add more.

El Paso Products, a subsidiary of El Paso Natural Gas Co., has done all these things in less than 3 years. In 1955 it had no refineries, no retail outlets. Today it's in business in a big way and further expansion seems inevitable.

The refinery . . . The new 9,000-bbl. refinery's Platformer goes into operation this week to put the plant fully on stream.

The company will get its high-octane raw material—the butylenes, isobutanes, and propylenes—as byproducts from the adjacent rubber complex, in which El Paso has a major interest. The refinery's alky plant will convert them to alkylate for blending into motor gasoline.

Process design was by Universal Oil Products Co., except for the alkylation plant, handled by Phillips Petroleum Co. Fish Engineering Co. was contractor for engineering, procurement, and construction.

Completion of the Odessa plant gives El Paso its second new refinery in 7 months and pushes the company's total capacity to 26,500 bbl. daily. The 8,000-bbl. layout at Ciniza, N. M., 10 miles east of Gallup, started processing Four Corners crude in December.

The company also has purchased, since October 1955, three small New Mexico refineries at Brickland, Prewitt, and Bloomfield, with a total capacity of 9,500 bbl. These, however, probably will be closed or sold.

The plan . . . Here is what is eventually in the cards:

The Ciniza refinery will supply all El Paso markets in the Four Corners area (the northern division), while the Odessa plant meets the company's product needs in a southern division comprising West Texas and southeast New Mexico.

Gasoline and other products from Odessa, however, may wind up in company stations as far away as Phoenix and other points in Arizona via the Southern Pacific products line.

El Paso's new products line from Odessa to El Paso, where it has a new 50-acre tank farm and terminal, has a daily throughput capacity of 7,000 bbl. with pump stations at Odessa and Black River. By adding more stations, the company can increase capacity to 18,000 bbl.

Retail outlets for El Paso have sprouted from an initial purchase of 125 "Dixie" brand stations from McNutt Oil & Refining Co. in 1955. This number has been doubled, and another 34 using the "El Paso" brand have been built. The two brands eventually may be consolidated.

El Paso, taking advantage of product quality its new refineries provide, expects soon to advertise a high-octane gasoline unsurpassed in the Southwest.

Indications are the fast-growing refiner and marketer will provide about 100 octane gasoline for the present, but it will be well equipped to go much higher if necessary.

Island Tests Due

off British Columbia. Six sites picked by Richfield.

RICHFIELD OIL CORP. will launch its drilling program this week on Graham Island off the coast of British Columbia.

The first of six wildcats will be started on the island, the largest of the Queen Charlotte Islands chain. Richfield's lease covers 945,578 acres, mostly off the coast of Graham Island (OGJ, June 2, p. 82).

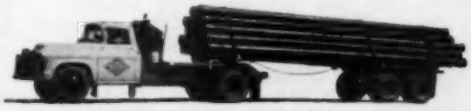
Richfield has tentative locations staked for six tests on the island itself. Cascade Drilling Co., Ltd., is moving a large-size rig to the island to start drilling the first well. There were reports that another contractor would move a rig in to help with the project.

The tests are expected to be carried to depths varying from 3,500 to 5,000 ft.

Richfield is the only major oil company holding oil and gas rights in the Queen Charlotte Islands. Most of its acreage is offshore in Hecate Strait, where the average depth is 50 ft. But the current exploration program is being confined to the island.

Congrats and $25 to J. A. LONG, Rua Uruguaiana 118 - 9° andar Rio de Janeiro, Brazil

Joe Roughneck, heart of the oil and gas industry, likes the convenience and economy of having Lone Star's ultra-modern pipe mill right in the middle of his workshop. Lone Star maintains the largest mill stock of API casing and tubing in the entire oil country. Delivery can be made overnight to 75 per cent of the active areas. Lone Star's recently enlarged plant is, more than ever, Joe Roughneck's solid source of supply.



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Union Changes Strategy

. . . in oil-industry negotiations. OCAW locals ordered to extend present contracts with quick wage reopeners.

ORGANIZED labor in the oil industry is switching tactics.

Blanket industry rejection of the 1958 bargaining program of the Oil, Chemical and Atomic Workers International Union is forcing most locals to secure extensions of their contracts.

The extensions, according to union headquarters in Denver, provide for reopening on short notice. This will permit continued negotiations at a later date in behalf of the union's 105,000 members in oil and related industries. Their average wage now is $2.70 per hour.

The strategy . . . This course of action was ordered by OCAW President O. A. Knight in letters of instruction to union directors and representatives.

Knight laid down procedures to be followed so that what he termed "showdown bargaining" could be pursued "at our own time and with companies of our own choosing."

Knight said this program would put OCAW "in the most favorable position in the event work stoppages are necessary." He did not elaborate.

The union's 1958 program calls for a cost-of-living wage adjustment, an increase of 3½% to compensate for greater productivity, substantial severance pay to laid-off workers, and longer term contracts. The proposed wage adjustments total about 19 cents an hour.

OCAW's last hope of establishing a national bargaining pattern this year faded when Sinclair Oil Corp. in mid-June turned a deaf ear on the union's contract demands (OGJ, June 23, p. 76). The OCAW contract covering about 9,000 Sinclair workers is the only nation-wide agreement in the oil industry where plant-by-plant bargaining is the general rule.

More dues . . . In event of a widespread strike, OCAW admittedly would be hard pressed to pay layoff benefits to its members for a prolonged period of time.

This was disclosed by International Vice President Elwood D. Swisher in an appeal for increased dues at a recent OCAW district council meeting in Bakersfield, Calif.

He said the union's defense fund might total nearly $500,000 by September 12, opening date for OCAW's annual convention in Long Beach.

But he added that this fund could be wiped out in a major strike situation almost overnight.

Chicago talks . . . Attention of the industry, meanwhile, centered on negotiations in Chicago between representatives of 350 oil companies and the Teamsters Union.

The talks were resumed late last week after a recess over the July 4 holiday without any new indications the parties are near an agreement.

Teamsters are asking a wage increase of 25 cents an hour above their present $2.75 rate plus other benefits. The union holds contracts with major and independent companies marketing throughout the Chicago area (OGJ, July 7, p. 71).

Industry negotiators admittedly are in a tough position in the Chicago parleys. Chicago teamsters already have successfully negotiated a 10-cent wage increase from other industry for dry-cargo drivers. But any increase oil companies grant to drivers of tank trucks may be used as a pattern by Teamsters and other unions in future negotiations with the oil industry.

Oil-industry position in labor negotiations so far this year has been strongly against wage increases because of the generally depressed economic conditions throughout the industry.

Antipollution Plan

sought by Arkansas agency for Smackover producers.

THE ARKANSAS Oil Association has been asked to submit by August 15 the details of its proposed 5-year plan to halt Smackover field pollution of the Ouachita River.

The Arkansas Water Pollution Control Commission completed two hearings on the issue at El Dorado recently. Monroe, La., had complained that pollution from Arkansas sources had made the Ouachita unusable as a municipal water supply.

G. T. Kellogg, technical secretary of the commission, told the association the commission will give "serious consideration" to an order that would stop pollution.

Kellogg told the association to submit its plan "in detail" showing "the action to be taken concerning each well" owned by companies which are members of the association.

President Robert E. Adair of the association told the commission at the recent hearings that if an order were issued halting salt water output immediately, it would force many operators to stop production because of the heavy expense involved (OGJ, June 30, p. 47).

Adair said the 114 operators who are members of the association are working on plans to cut salt water going into the Ouachita tributaries by 20% the first year and will complete the abatement program in 5 years.

Pipeline Project Approved

A FEDERAL Power Commission examiner last week approved a $167-million expansion program of Transcontinental Gas Pipe Line Corp.

The program is split into four projects. One calls for development and operation of the Leidy field and later the Tamarack field in Potter and Clinton counties, Pennsylvania.

The largest of the projects is a $137,200,000 construction of 556 miles of transmission line, 38,580 compressor horsepower, and 345 miles of purchase laterals to connect new gas supplies from southern and offshore Louisiana and Texas.

The other projects call for the building of 151 miles of purchase laterals from Louisiana fields.

PIPELINE

The 88 operating employes of Southern Pacific Pipe Lines, Inc., have voted against affiliating with the Oil, Chemical and Atomic Workers International Union. In a July 2 election held by the National Labor Relations Board, 87 employes voted 72.4% against joining the union.

Trans-Canada Pipe Lines, Ltd., has decided to purchase the government-built Northern Ontario Pipe Line Crown Corp. section of its gas line soon because of fast developing markets. C. S. Coates, Trans-Canada president, told the Borden Commission last week of the purchase plan. The Northern Ontario "uneconomic" section was built by the Ontario and dominion governments with Trans-Canada agreeing to a long-term lease and eventual purchase.

Application to build an $80,000,-000 LPG pipeline from Alberta to the Pacific Coast is to be made soon

Gas Decision Pondered

. . . by FPC and CATC. Appeal expected as next step. Fate of gulf gas reserves, meanwhile, hangs in the balance.

THE U. S. Government and the CATC group studied carefully last week the effect of the Philadelphia decision which knocks out an FPC order approving the sale of offshore gas reserves.

Until the Federal Power Commission acts on an opinion yet to be written by its general counsel, officials aren't talking about what the FPC will do.

These are the possibilities:

. . . **The FPC may file an appeal.** It has done so in other instances.

. . . **It may reopen the record** for the full rate inquiry which the court said should have been made.

The decision appears to leave the CATC group also in something of a dilemma. The oil companies (Continental, Atlantic, Tidewater, Cities Service) could:

. . . **Do nothing** and leave its huge Gulf of Mexico gas reserves shut in.

. . . **Try to find intrastate markets** at attractive prices and thus avoid federal regulation.

. . . **Go ahead** with its proposed sale of gas to Tennessee Gas Transmission Co. and leave the final price to be determined in the future by the FPC.

The decision . . . The decision that caused all the furor was written by the Third Circuit Court of Appeals at Philadelphia (OGJ, July 7, p. 82).

The court held that the FPC, in approving the rate base, had failed to determine whether the contract between CATC and TGT was in the public interest.

The contract provided for 22.4 cents per M.c.f. at the outset and a scaled increase to 35.4 cents over 20 years.

What's ahead . . . In the event no appeal is taken, the FPC probably will docket the reopened case for hearings this fall.

If the Philadelphia decision is appealed, it may be a year before a final ruling is handed down by the U. S. Supreme Court.

On the other hand, the Supreme Court could cut off further court action by refusing next October to review the case. The court, on the average, has accepted only one out of about nine appeals involving FPC orders.

Interpretation . . . Gas attorneys in Washington, meanwhile, appeared split as to whether the CATC decision is more important than the Memphis case, which requires approval of all customers before rates can take effect.

The narrow grounds on which the Philadelphia decision is based, some say, make it difficult to interpret. But it is generally agreed that the FPC might have to reject any application in which the producer threatens not to accept the certificate if the commission should tamper with the initial price.

On the other hand, the Philadelphia court didn't say the FPC could not refuse to attach a condition to an initial price.

A couple of cases are pending before the FPC now in which the issue of a condition is involved. In several past cases the FPC has refused to impose a condition. But attorneys said that since there were no intervenors in those cases they will not be affected by the CATC decision.

Lawyers say the effect of the decision is that if any intervenor raises the question of price, the FPC must consider it.

And any applicant who resists an inquiry into price is an "unwilling seller" with no standing before the commission.

BRIEFS . . .

by a new company, Foothills Products Pipe Line, Ltd. The company is formed of a group of Canadian businessmen sponsored by Pembina Pipe Line, Ltd. and Mannix Co., Ltd.

The company has spent several months in research and engineering investigating the feasibility of the line, design, route locations and the economic aspects of such a project. Also under study was a gathering system to tie in liquid byproducts from both present and future gas fields of the province.

Bottineau Pipeline Co. is seeking permission from the North Dakota Public Service Commission to build a gathering system and 18-mile trunk line from Newburg field in Bottineau County. The line would move Newburg crude to the railroad.

United Gas Pipe Line Co. plans to start September 1 on 117 miles of 30-in. from southeast Louisiana to Mobile, the largest part of its current expansion program. United has completed 46 miles of 12 and 20-in. connecting new gas supply in Texas and Louisiana. During the rest of the year, the company also will lay 64 miles of 8, 12, 16, and 20-in. supply lines.

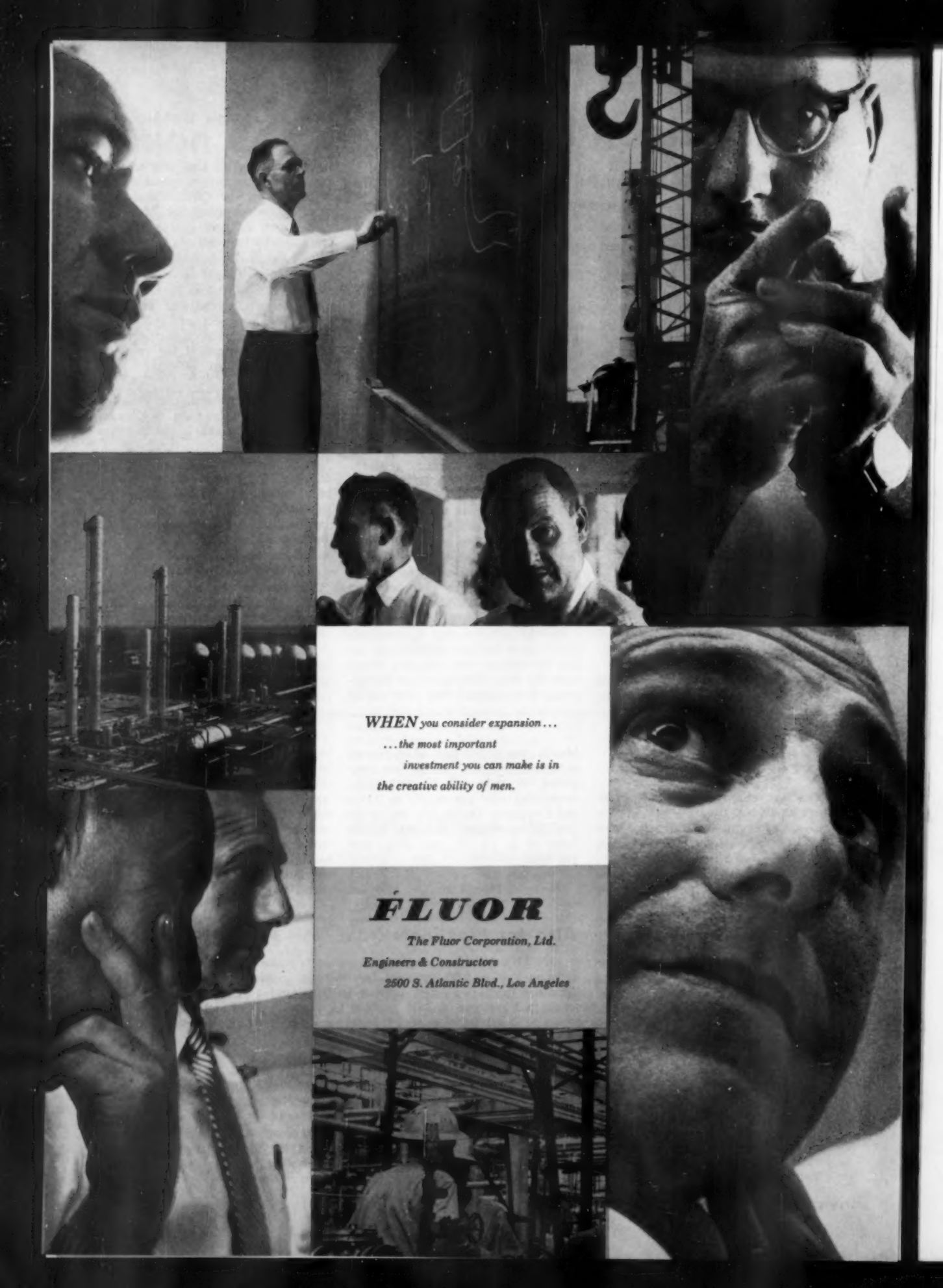
Buckeye Pipe Line Co. said last week that its dual 8-in. crude system was dynamited near Trenton, Mich. The lines supply refineries at Trenton and Detroit, location of Aurora Gasoline Corp.'s plant where OCAW members have been out on a wildcat strike for 2 months. The FBI is investigating the case since Buckeye is an interstate carrier. Ruptured lines were being repaired last week.

Also for Pipeliners . . .

IN THE NEWS: Canadian independents make strongest bid for Montreal refining market with proposal for 36-34-in. crude line from Edmonton to Montreal (p. 64) . . . FPC decision in fight for big Midwest gas market may come in November (p. 75) . . . Both U. S. Government and CATC group are studying court decision which knocks out an FPC order approving sale of offshore gas reserves (p. 79).

PLUS THESE TECHNICAL REPORTS: Complex centralized control is possible today (p. 89) . . . Four Corners Pipe Line operated by remote control (p. 92) . . . Remote control of internal-combustion-engine stations (p. 97) . . . First push button gas pipeline operating successfully (p. 114).

Last Pipeline Construction Report, with a complete list of projects, appeared July 7, pp. 153-162. Pipeline Construction Report will be published again July 28 and regularly thereafter in the last issue each month. New projects and contracts will appear weekly in Pipeline Briefs.


WHEN you consider expansion...
...the most important
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the creative ability of men.
FLUOR
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Low Bridges=Low Blow

. . . to South Louisiana drilling operators. Proposed lower canal spans would force dismantling or block most barges.

ALREADY BESIEGED in a battle against rising costs and low allowables, South Louisiana operators now have to defend themselves from attack in a new direction.

The new danger comes from an unexpected quarter—Louisiana's Department of Highways. Actually, the department's target is the U. S. Corps of Engineers. But, it stands to make a direct hit on the oil industry.

The Louisiana body has asked the engineers to lower the clearance required on future bridges over the Intracoastal Canal and its tributaries. These waterways are the life lines to much of the active oil area on the Gulf Coast. Both inland and offshore drilling barges regularly ply these water highways when changing locations, docking for repair, and seeking shelter from hurricanes.

A few badly placed low bridges could barricade the canal and its feeders permanently to about 40% of all drilling barges. The remaining 60% would face the expense of dismantling before passing under a bridge. Cost to the oil industry might easily run into millions of dollars annually. And, paradoxically, it could cost the State of Louisiana and its citizens as much in bonuses and delayed royalties.

No ruling yet . . . The Corps of Engineers has heard evidence on the matter but has made no ruling yet. Many oil industry leaders are hopeful that the requirements will remain unchanged at 73-ft. clearance.

The Department of Highways originally had asked that it be allowed to build fixed-span bridges with as little as 20-ft. clearance. No drilling barge afloat could squeeze under such a span. Aim of the department is, of course, to keep down the cost of such bridges. Lately, it has hinted it might settle for clearances of 50 to 55 ft.

Charles Norton, president of Norton Drilling Co. and the New Orleans chapter of the American Association of Oilwell Drilling Contractors, gave some interesting figures at a recent Corps of Engineers hearing in New Orleans. With help of major companies he has compiled "vital statistics" on 265 mobile barges and 54 LST-type tenders. He says this covers all such equipment in the area as far as he can learn. The equipment is valued at about $541,250,000.

Norton testified that 16% of all the drilling barges couldn't be dismantled far enough to get under a 73-ft. span. He has now revised this estimate to 24% of all barge rigs. Some 40% of the barges couldn't pass under a 55-ft. bridge even when fully dismantled.

The rigs which can pass the 73-ft. span by tearing down the derrick to the standpipe, Norton estimates, would face an average dismantling cost of $6,025 each passage. The 60% of all rigs which could pass the 55-ft. span would come through $8,025 lighter for the dismantling.

Norton testified that each of the drilling barges uses the Intracoastal Canal an average of four times each year. Or, the industry makes about 892 moves in the waterway annually. Thus, even one low bridge at a busy spot could cost the oil industry more than enough to have built a higher-clearance span.

In the Atchafalaya basin . . . Norton told the engineers that the tributaries to the Intracoastal Canal are important, too.

These feeder streams carry rigs into such oil areas as the Atchafalaya basin. This huge area is far inland but it is so swampy that much of it has to be drilled with barge rigs. And, water level in many places varies as much as 8 to 15 ft. during the year.

Fixed bridges on the streams might mean that they would be passable to barge rigs only during low-water periods. The inevitable result would be spasmodic development, lower bonus bids, and delayed royalties. Here, the State of Louisiana, which owns many leases in the area, would join the oil companies in the loss column.

Price-Fix Case Move Sought

ATTORNEYS for oil companies indicted last month on a criminal charge of price-fixing have launched a frontal attack on the Government's case.

As their first move, they filed a motion for a change of venue with Judge Albert Bryan of the Alexandria, Va., federal District Court.

This was to be followed up by a number of motions raising questions about the selection and actions of the special grand jury which returned the indictment, and asking for a bill of particulars.

The motion for a change of venue named the federal court for the Northern District of Oklahoma, at Tulsa, as the place where the companies preferred to appear, if the case gets to trial.

The other motions were technical in nature. Oil lawyers said that if granted, the Government's case might be thrown out of court.

Moving the case to Tulsa would take it out of what some lawyers consider the hostile atmosphere of the national capital. Alexandria is 4 miles from Washington. It would also save many of the defendant companies heavy transportation costs for their attorneys, witnesses, and documents.

Records kept . . . These initial moves came as company and government lawyers argued over the latter's motion to impound all the records secured by the grand jury during its many months of investigation.

Defense counsel protested that the documents sought by the Government contained trade secrets. And many of them are old records having no bearing on the alleged price-fixing activities of the indicted companies, they argued.

The session last week was the first of a series scheduled by Judge Bryan last month when he postponed arraignment of the 29 companies indicted on a single charge of price-fixing (OGJ, June 9, p. 68).

Only three of the companies have entered pleas so far. Cities Service Co., Cities Service Oil Co., and Arkansas Fuel Corp. pleaded innocent in advance of the session at which all 29 were to appear.

The motions filed by the companies may not cover all the points they will raise in the preliminary sparring. They have until August 1 to file motions that must precede arraignment.

A preliminary conference will be held August 10, at which time Judge Bryan may extend the period for filing if necessary.

The 26 companies that have not yet entered their pleas may be arraigned in September. Judge Bryan is to take the case up again September 10 to set the date.

Trunkline Gas to Expand

. . . pipeline system. Big project includes loops and 204-mile extension to connect with proposed Michigan line.

TRUNKLINE Gas Co. filed plans with the Federal Power Commission last week for an $81,500,000 expansion of its pipeline system to serve growing markets in Michigan.

Under the proposed expansion program, the Houston-based pipeline company would increase its delivery capacity by 135,000,000 cu. ft. daily by the 1959-60 heating season.

Trunkline announced that this would be the first step in eventually supplying 200,000,000 cu. ft. of gas per day to Consumers Power Co., Jackson, Mich. Consumers is one of Michigan's largest natural-gas distributors. It serves some 460,000 homes and 300 communities in Michigan.

The transmission company is seeking necessary permits so construction can begin by January 1.

Main segment of the expansion would be a 204-mile extension of Trunkline's main system from Tuscola, Ill., to the Illinois-Michigan border near Vistula, Ind. The extension would be of 26-in. pipe, and would connect at the Michigan border with the Consumers Power Co. system.

Big looping program . . . Also included in the proposed expansion is additional compressor horsepower in Louisiana and more than 500 miles of mainline looping.

Trunkline proposes to loop 463 miles of its mainline with 30-in. pipe. This would be along portions of the existing system between Longville, La., and Tuscola. In addition, 44 miles of 24-in. looping is planned along the existing system in Texas.

Compressor expansion would include an additional 3,000 hp. at the Longville station.

Direct delivery . . . The proposed expansion represents a departure for TrunkLine in that it would permit the company to make deliveries directly to a distributor for the first time. In the past, the company has delivered its gas to Panhandle Eastern Pipe Line Co., which has controlling interest in Trunkline.

W. K. Sanders, Trunkline president, said the facilities now proposed would increase the company's delivery capacity from the present 375,000,000 cu. ft. daily to 510,000,000.

"The Trunkline expansion is designed solely to supply Consumers Power Co., and there is no plan to attach other customers," Sanders explained.

Consumers' plans . . . Consumers will build a 120-mile, 26-line from the Michigan-Indiana border to Plymouth, Mich., 20 miles west of Detroit.

There are said to be more than 160,000 homes waiting for gas in the Consumers distribution area. Many of these homes would be served by the new supply from Trunkline, Sanders said.

Trunkline operates a 1,200-mile pipeline system which originates near the Mexican border at McAllen, Tex., and extends northward to Tuscola. The present mainline ranges up to 26 in. in diameter.

The company estimates it will take about 9 months to complete the construction program.

Principal markets served by Consumers are in the Pontiac, Flint, Saginaw, Lansing, Alma, Bay City, and Marshall areas.

PROCESSING BRIEFS . . .

Murphy Corp. has acquired new retail outlets in the Twin Cities area through the purchase of Northeast Oil Co., Minneapolis, from Waldo Carpenter. The purchase was made through a Murphy affiliate, River States Oil Co. River States handles the sale of products for Lake Superior Refining Co., Superior, Wis., another firm recently acquired by Murphy. Northeast retails its products under the brand name "Superior 400."

Shell Chemical Corp. has awarded contracts for a $10 million glycerin production project at its Norco, La., plant. Lummus Co. will do the engineering for an acrolein unit. Ralph M. Parsons Co. will engineer a glycerin unit and Fluor Corp. the offsite facilities. August Perez & Associates, New Orleans, did the design work.

Imperial Oil, Ltd., has started operation of a naphtha specialties unit at its Sarnia refinery and has announced plans to expand its Regina refinery for high-octane gasoline.

The $4.5-million unit at Sarnia will turn out 1,644 bbl. daily of solvents. Feed stock for the unit, built by Canadian Bechtel, Ltd., will come from the refinery's main distillation units. Contract for a 3,000-bbl. Powerformer at the Regina refinery will be awarded in August. Construction should be completed by late 1959.

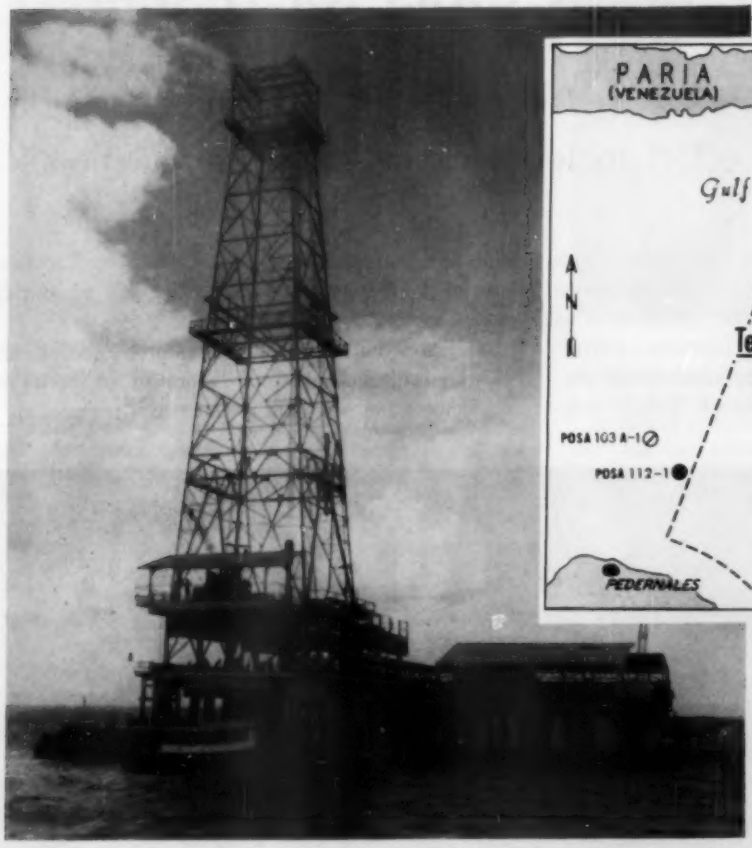
Sun Oil Co. and Olin Mathieson Chemical Corp. have agreed tentatively to join in building and operating a 73,000-ton-per-year urea plant at Sun's Marcus Hook, Pa., refinery. Raw material would come from Marcus Hook's ammonia plant. Sun and Mathieson will form a new company to run the urea operation. Details will be announced when plans are completed.

Dow Chemical Co. placed its second synthetic-glycerin plant on stream at its Freeport, Tex., petrochemical installation. The plant uses propylene as a base raw material and produces the finished product by means of a process developed by Dow's Texas division. The first plant went on stream in 1955.

Also for Refiners . . .

IN THE NEWS: Denver research report gives glowing report on economic future of shale oil (p. 63) . . . Chase Manhattan reports world-wide expenditures for oil were up 12% for 1957 (p. 67) . . . Voluntary import-control plan is under attack now both in Congress and federal court (p. 74) . . . El Paso Natural Gas Products, with a new refinery at Odessa fully on stream, is becoming formidable refining and marketing competitor (p. 76) . . . OCAW is changing tactics, is accepting extension of contracts with quick wage reopeners (p. 78).

PLUS THESE TECHNICAL REPORTS: Gas chromatography: A powerful new tool for chemical analysis (p. 122) . . . Process Costimating (p. 131).



FIRST WELL is already under way from Texaco Trinidad's new 36-well platform off Trinidad. It's designed for easy expansion to 72 wells. Derrick drills six holes from one position, skids itself ahead to drill another six holes.

Multiwell Platforms Invade Busy Paria

A FREIGHTER moving through the Gulf of Paria clipped and damaged a drilling platform one night last week.

The incident wasn't a major marine mishap, but it could be a forerunner of things to come. The gulf shows every indication it may get crowded.

The gulf, which separates Trinidad and Venezuela, is already showing signs of rivaling the Middle East's Persian Gulf as one of the world's hottest marine drilling areas. This is in sharp contrast to the declining activity in the Gulf of Mexico.

Every known drilling technique is being used in the Gulf of Paria. The standard stationary platform (like the one hit by the passing freighter) has already accounted for oil discoveries on both sides of the international boundary which divides the gulf—almost an inland sea. A mobile submersible barge built in Germany will soon start work on the Trinidad side. Two holes have already been drilled and a third is under way from a novel floating barge.

The latest wrinkles are big new multiple-well drilling platforms now appearing on both sides of the gulf.

The first of 36 wells to be drilled from one of the big platforms is already under way on the Trinidad side of the gulf. Across the international boundary on the Venezuelan side, a five-company combine plans a similar structure to develop its first find. The Texas Co. has an interest in both operations.

Multiple-well platforms . . . Texaco Trinidad, Inc., started drilling in May on the first of 36 wells planned for a mammoth permanent platform set in 68 ft. of water 1½ miles off the Brighton terminal pier on Trinidad's west coast.

Construction of the big platform was started last December by Raymond International, Inc., for Antilles Petroleum Co., Ltd. Last week Antilles went out of business as a company and all its assets and properties in Trinidad, including the offshore acreage, became a part of Texaco Trinidad.

Shortly after The Texas Co. acquired Trinidad Oil Co., Ltd., it purchased the stock of Antilles Petroleum from its 65%-owned Canadian affiliate, McColl-Frontenac Oil Co., Ltd.

The 52-by-157-ft. drilling platform mounts a derrick which drills six holes from one position and then skids to another spot for another six holes without another move. The drilling platform is supplemented by a 50-by-83-ft. machinery deck. Both structures are supported by 144-ft. prestressed concrete cylinder piles.

Fifty of the 36-in.-diameter concrete piles support the platform. Another 36 piles driven in parallel lines will serve as conductor pipes for the wells to be drilled.

(Continued on page 86)

Ethyl creates new tools for research

Instruments of variety and sophistication are developed in a continuing effort to learn more about combustion

ETHYL SCIENTISTS must be able to "see" what is happening inside an engine in successive millionths of a second to study such momentary phenomena as knock, wild ping and rumble.

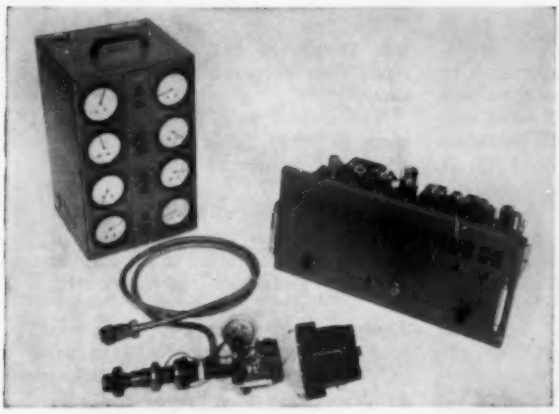
Standard devices for measuring combustion phenomena frequently are not fast enough. Ethyl's progress in combustion studies sometimes seems to have outrun the capacities of commercial instrumentation that is available today.

Therefore, in Ethyl's Detroit Research Laboratories, existing instruments are often modified for special requirements and new ones are created when needed.

THIS INGENIOUS DEVICE—a surface-ignition analyzer—looks at eight ranges of crankshaft rotation in five-degree increments and counts the number of surface-ignitions that occur in each range.

Using it, Ethyl research engineers proved that fuels of different composition tend to surface-ignite at different times in the engine cycle.

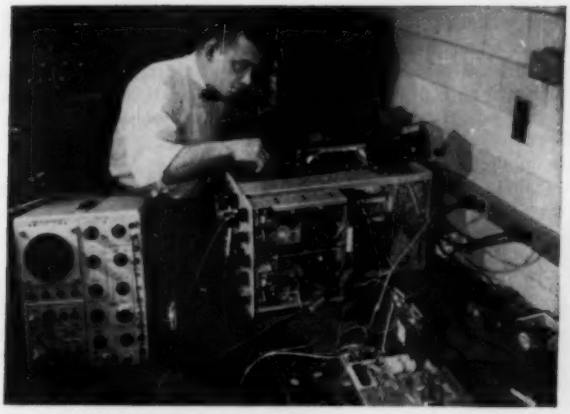
This technique also enabled better, quicker evaluation of the effect of gasoline additives such as phosphorus in reducing surface-ignition.



EACH CYLINDER in a multi-cylinder engine must reveal its own story during operation if surface-ignition problems are to be diagnosed correctly.

Several years ago, the device on the left was developed by Ethyl instrument engineers to count the number of surface-ignitions that occur in each cylinder.

Now, a new improved model, seen at right, provides digital counter readings for each surface-ignition event. The modified ignition distributor triggers the counters to operate at the proper time in the engine cycle.



ETHYL RESEARCH ENGINEERS in basic combustion wanted to observe four engine variables at the same time, using a single electron gun oscilloscope.

Since such an instrument was not available, Ethyl instrument engineers proceeded to modify a well-designed commercial model for this special purpose.

The resulting instrument, using high-speed (microsecond) electronic switches, permits continuous viewing of four separate engine events; in this case, two pressure signals and two timing signals.

THE BALANCED PRESSURE PICK-UP is a big step ahead in measuring combustion pressures accurately. But it does require another mounting hole in each combustion chamber.

An Ethyl engineer is designing this pick-up into a spark plug. The combined pick-up and spark plug can then readily be installed in the spark plug mounting hole.

ALL ETHYL CORPORATION RESEARCH findings depend upon accurate and reliable instruments, ranging from the simple glass-stem thermometer to the complex scintillation counter pictured in the photograph above.

A well-planned servicing and calibration schedule keeps hundreds of sensitive instruments "on the beam."

How Ethyl Research is helping you

By keeping alert to new instrument possibilities and techniques, Ethyl Research people are able to increase their own effectiveness and help expand the Oil Industry's knowledge of fuels, engines and combustion.

Ethyl Research Representatives are available at all times to give your people the benefit of our specialized knowledge in measuring combustion phenomena and other phases of fuel-engine research.

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RESEARCH LABORATORIES:
1600 W. Eight Mile Road, Ferndale 20, Mich.
2600 Cajon Road, San Bernardino, Calif.

The cylinder piles were made in Louisiana and shipped by barge to the platform site where a 50-ton floating crane swinging a single acting steam hammer was used to drive them. The pile caps were poured on the site, but all the deck frames were precast in frames 22 by 45 ft.

The derrick for the novel platform was designed and installed by Lee C. Moore Corp. Pumps and machinery were supplied by Oil Well Supply. Skinner Drilling Co., Trinidad, is contractor for the wells.

The new platform will probably mean an end to the directional drilling program which the company has carried out on the Trinidad shore opposite the location. Texaco Trinidad has been producing about 6,500 bbl. daily from these slant-hole wells.

Another multiple-well platform is planned for the area 27 miles west and just slightly south of the Brighton installation. Texaco will have a part in this operation also.

Paria Operations, Inc., which paid $100 million to Venezuela for new concessions on the Venezuelan side of the boundary, plans to erect a similar platform to drill more than 25 wells near its first discovery, POSA 112-1.

POSA 112-1 drill-stem tested about 1,500 bbl. of 20°-gravity crude from two sands found between 4,000 and 4,500 ft.

The rig which drilled the discovery is now under way on a second test, POSA 103 A-1, spotted 4 miles northwest of the discovery. It was this platform which was brushed by a freighter during the night shortly after the drilling crew had cemented 9⅝-in. casing in the hole. There was some damage to anchor lines holding a drilling tender and also to some mud and power lines on the platform, but no one was injured.

Paria Operations is owned by Texaco, Continental Oil Co. and Ohio Oil Co., each holding 25%, and Cities Service Co. with 16⅔%, and Richfield Oil Corp. with 8⅓%.

The floating drilling . . . On the Trinidad side of the gulf, and to the north of Texaco's big platform, Dominion Oil, Ltd., is drilling its third widely spaced test.

Dominion, a wholly owned subsidiary of Standard Oil Co. of California, is doing its drilling from a floating barge in an effort to test the stratigraphic potential of its big offshore license covering much of the northwestern part of the gulf.

Dominion's floating platform is a converted supply barge, the McDermott Tidelands No. 4. The unit is 240 ft. long, 72 ft. wide, and 15 ft. in height.

It is held in place on location by six 6,000-lb. Danforth anchors, with a double and single windlass at each end of the barge. Each of the windlasses spool from 1,000 to 1,500 ft. of 1¼-in. cable. Drilling operations are carried on through a 12-in.-diameter well cut in the center of the barge.

Underwater equipment includes a guide funnel, a Shaffer rotating head, a Hydril preventer, and a Shaffer double gate preventer. All are attached to surface casing by a locking safety joint which can be released, allowing the preventers to be brought to the surface for inspection or repair.

The submarine was first used to seal off the hole from sea water, but now a drilling nipple which extends through the barge well is used. This compensates for the vertical tidal movement (3 to 4 ft.) and very slight lateral movement. When the submarine head is used, two 4-in. rubber hoses are used for mud return. The drilling nipple accomplishes the same purpose.

The drilling so far . . . The Socal subsidiary started its drilling after spending 5 years and $1 million on geophysical and geological exploration of its offshore acreage.

The company says it has spent $1,250,000 on its drilling so far. Costs were high on its first hole, but the company says it has been able to reduce its cost per foot substantially.

The first hole, Couva Marine 1, was abandoned below 7,000 ft. in April after encountering a small gas show.

The second hole, Domoil 1, only went to 2,535 ft. It was drilled in 85 ft. of water 21 miles west of Trinidad.

The test now drilling is in 104 ft. of water and is only 4 miles from Trinidad's coast on the south edge of Dominion's offshore concession area.

Equipment performance . . . Dominion said last week as much as 6,000 ft. of 3½-in. drill pipe has been racked in derrick on this barge—but only after a careful check of weather forecasts. A 6 to 7-ft. draft on the barge plus a minimum amount of free surface in liquid storage tanks reduces the roll of the barge and retards its tendency to drag anchors in heavy seas.

The 5-in. casing was substituted for cable block guides at the second well drilled because the barge encountered long swells and 5-ft. seas.

The tension devices for guide lines are not used except when the guide lines are needed for entering the hole. One 2-ft. stroke bumper sub is used on the drill string to keep a constant weight on the bit.

Dominion says one of the biggest problems it encountered was setting the first casing string in the soft mud bottoms found in the Gulf of Paria. Crews licked the problem by suspending pipe until it "freezes" after cementing.

Kermac Drills on Barbados

GULF OIL CORP., one of the most active companies in Caribbean oil exploration, has taken on another partner in that part of the world.

Gulf revealed last week that Kerr-McGee Oil Industries, Inc., is already drilling below 8,594 ft. on a new test of the Island of Barbados.

The test is planned for 15,000 ft. When it is finished Kerr-McGee will have earned a 25% interest in Gulf's Barbados operation.

The new test is Gulf Morgan Lewis No. 1 on the Morgan Lewis plantation in the Scotland district of Barbados near Belleplaine. It was spudded March 17. Gulf revealed the new agreement with Kermac after the deal was given the approval of the Barbados Government.

Barbados Gulf Oil Co. halted its exploration on the British West Indies island more than a year ago after it worked for 7 years and drilled five wells without finding commercial oil. At that time Gulf said emphatically it was not quitting the island, but only calling a temporary halt to drilling to evaluate information.

At that time, the company had only about half the island's 166 sq. miles under concession and asked the government to extend its license to cover the entire island (OGJ, Apr. 15, 1957, p. 103).

Farmouts increase . . . The new farmout agreement with Kerr-McGee follows the pattern which Gulf has set recently in the Caribbean after working throughout the area for years on its own.

In the last 2 years, Gulf has farmed out part of its Cuban acreage to The Texas Co. and Cuban Kewanee Oil Co., which are now drilling deep tests on the island.

Last November, Shell Petroleum Co. took a 50% farmout on 4½ million acres held by Gulf in Brit-

ish Honduras. Gulf later gave California's Bandini Petroleum Co. a farmout on another 144,615 acres in the southern part of the country.

The biggest deal Gulf now has under way in the Caribbean is a joint venture with Standard Oil Co. of California in the Bahamas. The two companies pooled their prospecting licenses covering almost two million square miles of underwater area.

They are now drilling below 8,000 ft. at Cay Sal Bank on a major test expected to go to 15,000 ft.

New Laws Studied

by Spain, Morocco. Both seek 50-50 profit split.

BOTH Morocco and Spain are studying new oil laws which would include the traditional 50-50 profit split.

Spain's proposal, based on contracts in the Middle East, is expected to pass later this year.

Morocco, which wants a share in the oil fever gripping North Africa, hopes to lure foreign oil companies to that country with a new law that will probably become official before the end of the month.

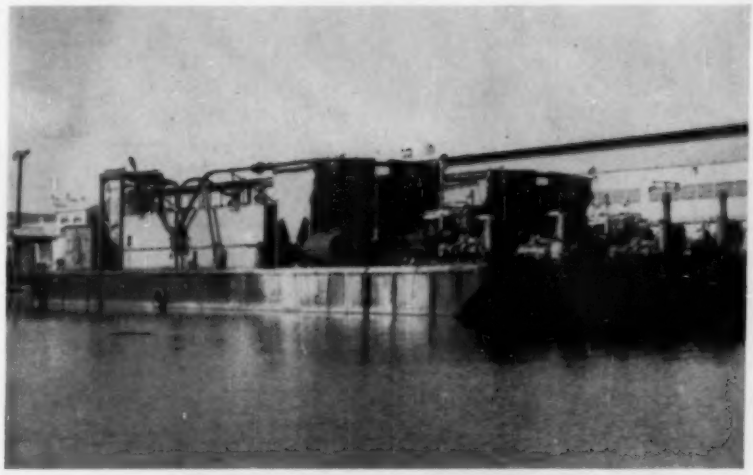
The Moroccan Government plans to offer exploration concessions with a 12-year term and exploitation concessions for 50 years. The new law has been presented to Morocco's cabinet and will probably be made public soon.

Only one company operates in Morocco now under the terms of the old general mining legislation. Ste. Cherifienne des Petroles, controlled by the French oil agency, produces about 1,600 bbl. daily from a number of small fields in northwestern Morocco.

Spain's plans . . . Spain's proposed law puts limits on acreage available to any individual firm, and half of any concession block will be given up when an exploration license is changed to a development license.

Exploration in Spain has been limited by an unfavorable law for newcomers. One new bill reportedly has passed the council of ministers and is now in the hands of the parliamentary committee for industry.

General American Oil is the major owner in an American syndicate now carrying on a joint exploration program with an agency of the Spanish Government. The most interesting wildcat so far was a 10,850-ft. dry hole completed last year in southern Spain near Seville. It found a 4,000-ft. section of limestone with zones of good porosity.



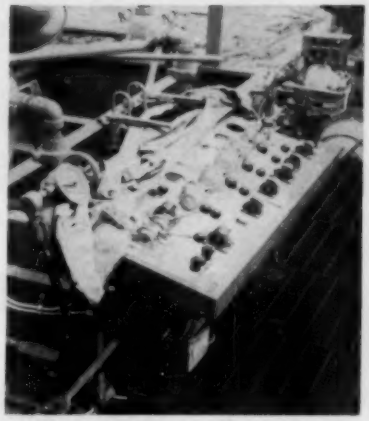
"Cement Stations" Head South

TWO CEMENT barges—described as "floating cement stations" — will soon go to work in the bustling Lake Maracaibo oil operations.

The barges (top photo) recently were completed at Higgins, Inc., shipyards at New Orleans for United Oil Well Service, S.A., subsidiary of Dow Chemical Co.

Each of the barges is of 500 deadweight tons displacement. They are designed to handle the cement and admixtures, both in and out, by pneumatic and hydraulic drives. Each can handle 6,000 sacks of bulk cement in 12 compartments.

The slurry mixing tankage outlets are equipped with radioactive slurry densitometers, which measure the fluid density of the cement. The density is determined by measuring a radioactive source passed through the cement slurry. Part of the radiation is absorbed by the slurry and it is proportional to the slurry density (OGJ, April 28, p. 88).



CONTROL PANEL for slurry mixer and the two cement pumps.

Pure Tests Big Paraguay Concession

PARAGUAY'S first wildcat in more than 9 years was spudded last week by a five-company combine of Americans.

The well is being drilled by Pure Oil Co. of Paraguay, Inc. which holds a 30% interest in the 23,200-sq.-mile concession. Pure, which got the original concession from the government, is the operator for the five partners.

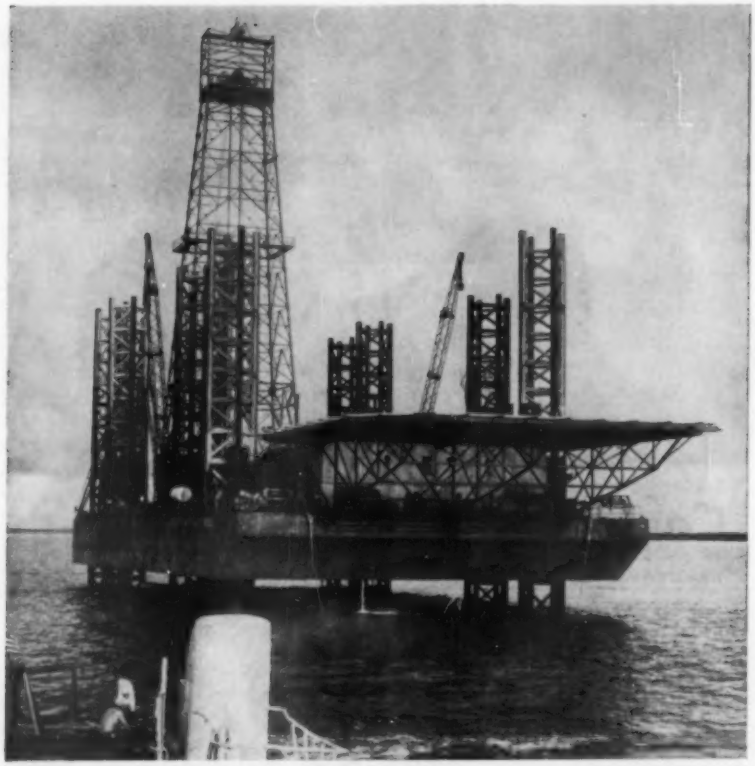
Williams Bros. Co., Tulsa pipeline construction contractors, has 20%; Paraguay Gulf Oil Co. 25%; Sinclair Paraguayan Oil Co. 15%; and Tidewater Oil Co. 10%.

The well was spudded after a 120-mile road cut through the rugged Chaco region of northern Paraguay was completed.

The rig was shipped from Houston shortly after the first of the year and moved up the Paraguay River to Puerto Casado. From this point the 2,400 tons of drilling equipment was shipped on a narrow-gage railway another 70 miles west to the point the road building had to begin.

Pure agreed to drill two wells within 8 months when it was granted the concession last October (OGJ Oct. 14, 1957, p. 120).

The test is Paraguay's first since Union Oil Co. abandoned a concession in the late 1940's after drilling five dry holes.



"RIG 55" explores big block in Central America where . . .

Deep Panama Test Under Way

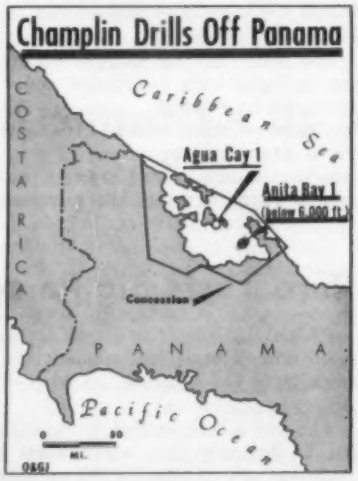
PANAMA'S first offshore drilling venture and its projected deepest well was drilling ahead last week below 6,000 ft. in Tertiary rocks.

The wildcat, scheduled to 12,500 ft. or deeper, is the Anita Bay 1 located in Laguna de Chirique, a big island-dotted lagoon on the north coast of Panama near the country's western border.

The well is being drilled by three U. S. independents making a bid to develop oil production outside the United States. Champlin Oil & Refining Co., Fort Worth, is operator for itself, Kerr-McGee Oil Industries, Inc., Oklahoma City, and Southland Royalty Co., Fort Worth.

Champlin holds a half interest, and Kerr-McGee and Southland each a quarter interest in an 870,000-acre concession—most of it submerged lands (OGJ, Sept. 16, 1957, p. 118).

The Anita Bay 1, in 45 ft. of water, is the first of at least two tests Champlin will drill on the concession. The second, the Agua Cay 1, has already been staked in the central portion of the lagoon. Both locations are on substantial structures located during extensive seismic work last year.



Rough trip . . . Contractor on the two offshore wells is Offshore Co., Baton Rouge. The rig involved is Offshore's "Rig 55."

The big mobile platform, measuring 110 by 200 ft., was towed a stormy 1,800 miles to location from the U. S. Gulf Coast. The voyage took more than 3 months.

It was hit twice at sea by tropical storms and had to put in to port at Jamaica for repairs.

The Anita Bay 1 was finally spudded in May 30. Champlin expects to reach its projected 12,500-ft. depth in about 90 days from start of drilling if everything goes well. Actual total depth, however, depends heavily on information gained during drilling.

Drilling crews work 20 days and are off 10. Offshore Co. flies them in all the way from Baton Rouge, La., and back again when their tour is finished. Average flying time one way is about 10 hours. The planes land on a strip at Bocas del Toro on Columbus Island in the northwestern part of the lagoon.

Drilling headquarters base is at Almirante, a small village on the west coast of the lagoon. Crews and supplies get to the rig site from both Bocas del Toro and Almirante via a 45-ft. crew boat. H. V. Myers is superintendent for the drilling contractor. Tool pushers are Leonard E. Craig and C. J. Parker, Jr.

Oil prospects good . . . Champlin is highly optimistic over the prospects for oil.

Its optimism is based on favorable results from reflection seismic work blanketing more than half a million offshore acres during 1957 in which seismic crews shot up more than 175,000 lb. of dynamite. Refraction work also was done to establish depth of the sediments in the area.

This in turn was supplemented by surface geological work on shore and by aerial photo geology. Champlin says the combined program disclosed that:

. . . **Sediments** are at least 12,000 ft. thick.

. . . **The drill** will penetrate Miocene, Oligocene, and Eocene sediments.

. . . **Numerous anticlines** and folds with pronounced closure or relief lie under the concession.

Delhi's seismic work . . . Across the Canal Zone near the Colombian border, Panamanian Delhi Petrolera, Inc., a subsidiary of Delhi-Taylor Oil Corp., Dallas, is concentrating on seismic work.

The company has dropped its stratigraphic drilling program on its 1,660,000 acres of concessions after drilling only 4 of an originally planned 250 strat tests to depths of 800 to 1,800 ft. (OGJ, Nov. 25, 1957 p. 79).

Company sources said geologists in the field found they were unable to get the information they sought from the tests. Delhi still thinks it will drill its first well in Panama next year.

Complete centralized pipeline control is possible TODAY

"The speed with which any given company can adopt complete automation will depend largely on the number of men it trains to handle the new concepts and modern equipment. New skills, new equipment, and additional personnel are the key words to automation. And automation in the form of complete centralized transport control is possible today."

BY GEORGE W. McGINLEY
Supervisor of Systems Sales,
Union Switch & Signal Division of
Westinghouse Air Brake Co.

A DEFINITE movement toward centralized systems control in the pipeline industry has been started in recent years but, for the most part, the control industry is paying mere "word service" to this type of automation.

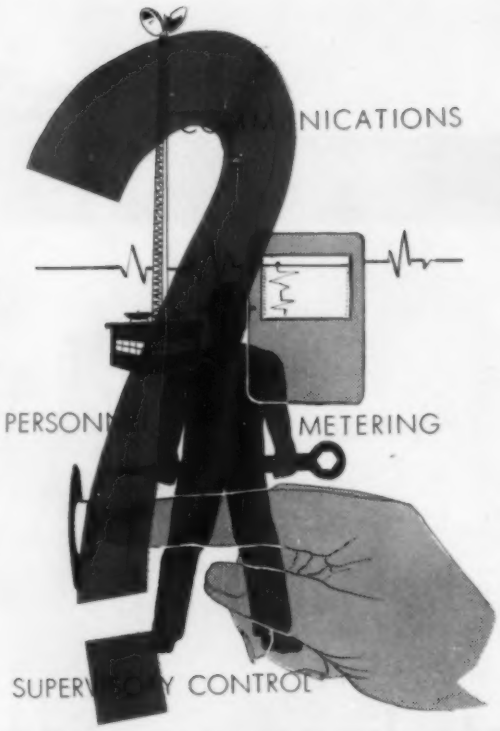
Too often we read of the desirability of complete or full automation, and the need for improved instrumentation, or of the future of systems control. Such conjecture is natural, and projecting automation plans into the future is commonplace since the attempt to expand and improve present-day operations is continuous.

The future holds much promise for the automation of pipelines, it is true. However, the fulfillment of this promise does not lie in theorizing about how the job should be done. In the last 3 years rigorous centralized control philosophies, which include provisions for ultimate automation, have been proved repeatedly in service. The hardware for systems of this type is available today, even in packaged form.

It is time we took a long and hard look at what is currently available to the industry for centralized control of the giant networks of pipelines. The objective is to obtain the most effective, expeditious, and profitable operation of a product-handling situation by utilizing up-to-date equipment and methods.

Extended delays in applying available equipment can prove to be a costly mistake in the long run. Awaiting the results of another company's experiments and experiences can easily place your own company's operations far behind the times. The truth of the matter is that the means for establishing successful centralized supervisory control over any pipeline system are here today.

"... In the past many reasons were given as to why it would be impossible to control the complete operation of a pipeline of any length from a central or master location."



Past Deterrents to Centralized Control

In the past many reasons were given as to why it would be impossible to control the complete operation of a pipeline of any length from a central or master location.

The most often stated reasons were:

- Older techniques required extensive communication facilities.
- Accuracy was limited in older telemetering methods.
- Unattended operation was unsafe.
- Supervisory systems of the day lacked security.
- The reliability of centralized operation was doubtful.

Deterrents Eliminated

Today, however, leaders of the industry readily admit that the advent of centralized-control philosophies and the development in the past 3 years of systems based on these philosophies have eliminated the deterrents stated above. A new concept of centralized control has evolved in which telemetering and supervisory functions play a leading part.

Centralizing the control of a pipeline system involves the application of several technologies which include communications, instrumentation, data-acquisition control and data handling. A successful centralized-control system must treat the application of these techniques from the systems standpoint in order to achieve maximum security, reliability, and economic operation.

What Has Been Accomplished

Centralized transport-control systems have been installed in which all pipeline operations except maintenance, repair, and construction are performed by centrally located equipment. Such systems are capable of operating with greater efficiency than is now possible with decentralized and near-obsolete equipment.

Full automation results in a degree of operational efficiency never before possible. Reduction in costs, improved safety and continuous vigilance in monitoring are additional resultants. Close examination of a recently installed centralized transport-control system in a large pipeline company revealed this to be true.

In this operation, remote stations are unattended except for weekly maintenance inspections. The centralized data-handling equipment has made it possible to dispatch twice as many compressor stations and six additional measuring stations without adding personnel to the dispatching operation. One man per shift dispatches the entire pipeline.

In addition, experience with the pilot satellite station has developed figures showing 8,000 hours of operation without maintenance to the centralized control equipment. During this operation there were no false operations of the equipment.

Similar security and reliability of operation are assured in the operation of five new centrifugal stations. Investigations by insurance people has augmented proof that the techniques employed in station design, control, and monitoring have resulted in a compressor station with a higher safety factor than the current attended stations.

The initial cost of compressor stations designed to fully utilize centralized transport-control techniques and equipment is less than that of conventional compressor stations which do not have added safety features incorporated into the centrally controlled stations. It has been shown that the cost of a centrally controlled station is approximately 10% less per installed horsepower than the cost of the conventional station.

All of this eventually adds up to better service to the ultimate consumer and enhances a company's competitive position. Savings on direct labor reduce basic transmission costs. Lower maintenance thereby insures reliable delivery of products and lower operating costs.

Why Deterrents No Longer Apply

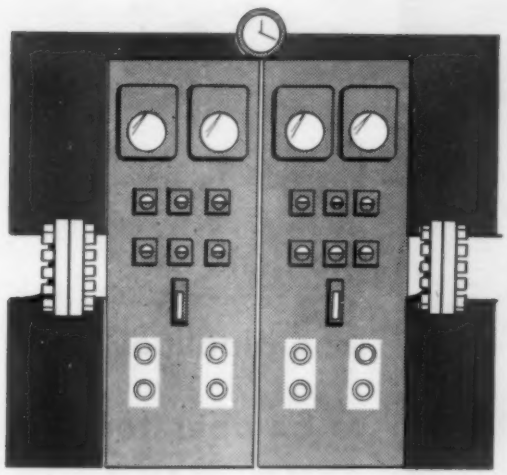
These facts bring us back to our original premise that complete equipment for centrally operating a pipeline is available today. The five deterrents listed above are no longer applicable. Centralized control systems do not require extensive communication facilities.

The first-stated reason was based on capabilities of telemetering and supervisory-control equipment available to the industry at that time. This older telemetering technique generally required individual channels for each measured variable to be transmitted. Similarly, supervisory-control equipment available at that time was not designed to meet the exacting requirements of centralized operation.

As for deterrent No. 2, telemetered variables can now be transmitted with complete accuracy. Data quantities such as station suction and discharge pressures, pump-case pressure, and flow can be telemetered to the master station and displayed on the control panel simultaneously.

This information is transmitted by digital methods when a significant change occurs, at the request of the dispatcher, or on elapsed time. Telemetering principles today are based on the axiom that "If information is worth sending—it is worth protecting!"

Today definite means have been devised for insuring total security of



"... Complete equipment for centrally operating a pipeline is available today. The five deterrents listed above are no longer applicable."

operation. In many remote control systems, in the past, an outside electrical disturbance such as lightning could become a "phantom operator" by distorting a command so that an operation other than the one desired was initiated.

Today's centralized control systems provide many levels of security as built-in protection against such interference. These levels of security permit transmission of data without error.

As for reliability, modern manufacturing processes guarantee a long life of trouble-free and dependable operation of any equipment installed. Time-tested equipment is inherently rugged and free from components which have a limited or short life.

And as far as safety is concerned, centralized-control philosophies place intelligence for operation of equipment at the field location, and modern monitoring techniques permit continuous surveillance of operating conditions.

Such continuous surveillance was not possible with a human operator. When these monitoring circuits are integrated in a sequence control system, shutdown of equipment can be initiated by limit sensing devices immediately upon detection of an unsafe condition.

These means for establishing complete automatic control of a pipeline system are here today. A continued insistence on delay can result in expensive redesign and rebuilding programs later on.

Personnel Displacement No Major Problem

Much has been said about the problems of replacing the operating crews with computers. In many instances, the term "automation" arouses concern among employes of pipeline companies. But the truth of the matter is that there is no need for any great displacement of personnel. If anything, there will be a new demand for adequately trained personnel to handle existing centralized facilities.

Companies will find it necessary to institute training programs to make available and develop the new skills which are necessary to make this type of automation work. Executives as well as operators of machinery will have to be trained, or retrained, to keep up with the latest techniques.

According to the latest statistics available, it is predicted that the gas-utility industries alone expect to spend more than 36 billion dollars for construction between now and 1970. There is no doubt in our minds that such a construction program will embrace the processes of automation.

Construction expenditures are expected to reach a yearly peak of 3.6 billion dollars in 1970. Today the gas industry is serving 30.3 million customers. By 1970 that figure will jump to 43.7 million. This is an expected increase of nearly 45%.

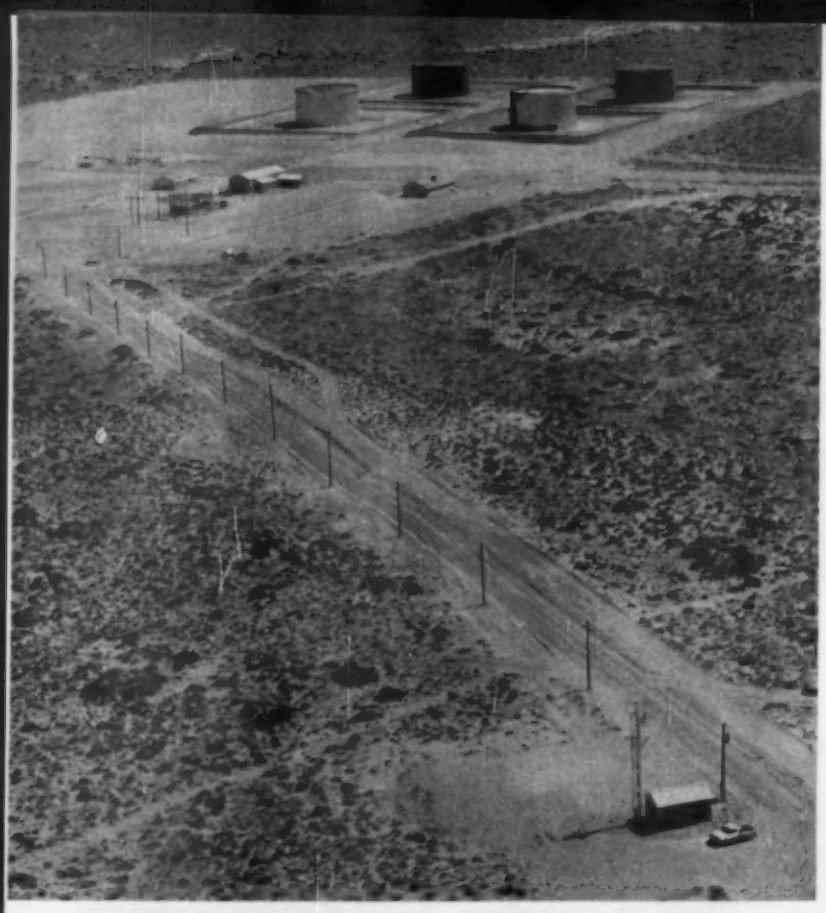
In addition, it is expected that the gas industry will be operating 858,000 miles of mains by 1970, as compared with an estimated 543,000 miles which are in use today. Transmission-line mileage also will rise from 157,000 (1957) to a total of 260,000 in 1970. Distribution lines will increase from 336,000 to 513,000 miles.

And as far as manpower requirements are concerned, the industry forecasts that employment will reach 266,000 by 1970 as compared with approximately 205,000 employes today.

A similar trend has been noted in the petroleum industry. During a 1-year period ending in 1957, statistics involving 60 oil-pipeline companies reveal that there has been an increase of 10,724 employes. This is a 2% increase over the number (663,196) employed in these companies during 1956. So it can be seen that, with the assured expansion of the pipeline industry, there must be an increase in the amount of personnel that will be necessary to operate the gas and oil pipelines of the future.

The speed with which any given company can adopt complete automation will depend largely on the number of men it trains to handle the new concepts and modern equipment. New skills, new equipment, and additional personnel are the key words to automation. And automation in the form of complete centralized transport-control is possible today!

"... The truth of the matter is that there is no need for any great displacement of personnel. If anything, there will be a new demand for adequately trained personnel."



RED MESA ORIGINATING station, a lonely outpost in Four Corners, is controlled from Los Angeles, over 600 miles away, over a microwave system (lower right).

Special Report

Here it is . . . the first new long pipeline to be operated completely by remote control

THE FOUR CORNERS PIPE LINE is designed for complete unattended operation. The main-line pump stations, pressure-reducing stations, delivery valve stations, booster pumps, and tank-filling and suction valves are designed for remote operation. Most of the feeder stations are equipped for automatic-custody-transfer operation.

The communications and control design provides for safe and reliable operation of the pipeline from the dispatcher's office in the terminal building located at the western terminus of the line.

The controlling point receives all of the telemetered quantities, pressures, flows, gravity, and set points necessary for the remote operation of the unattended facilities. All necessary local fail-safe protective devices are provided at the various locations to permit safe operation during communications or supervisory-control equipment failures.

Pump-Station Design

All trunk-line pump stations use 900-hp. electric - motor - driven centrifugal pumps. Three units are installed at Red Mesa, the initial sta-

Article prepared by the engineering department, Shell Pipe Line Corp., under supervision of O. W. Heyden, chief engineer.

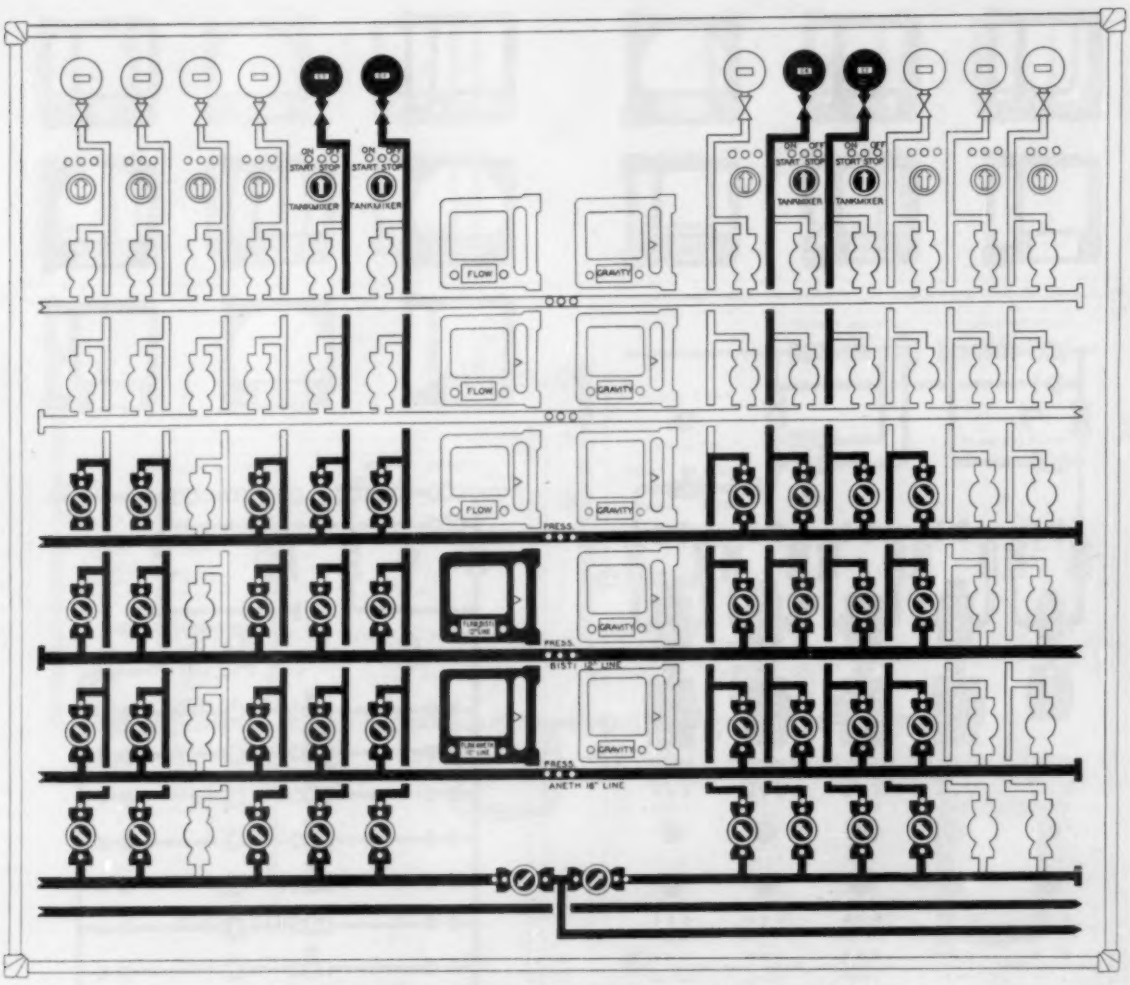
The Four Corners Pipe Line . . .

The Four Corners Pipe Line which was constructed to provide an outlet to the West Coast for the crude oil produced in the San Juan (New Mexico) and Paradox (Utah) basins began operations in April 1958.

Four Corners Pipe Line Co. is owned by Continental Pipe Line Co. (10%), Gulf Oil Corp. (20%), Richfield Oil Corp. (10%), Shell Oil Co. (25%), Standard Oil Co. of California (25%), and Superior Oil Co. (10%). Shell Pipe Line Corp. is agent in charge of construction, operation, and maintenance.

The line consists of approximately 618 miles of 16-in. trunk line and 147 miles of 4, 6, 8, 10, 12, and 16-in. feeder lines, 15 feeder stations, 3 trunk-line pump stations, 2 pressure-reducing stations, and 7 valve stations for handling deliveries in the Los Angeles area. The line is at present capable of delivering 70,000 bbl. of crude oil daily to refineries in the Los Angeles area. With the addition of 11 pump stations, the capacity can be increased to 160,000 bbl. per day.

The entire line with the exception of the feeder stations which for the most part are automatic, is remotely operated from the terminal office building in Los Angeles County, California. Remote operation is effected by means of supervisory control and telemetering equipment operating over a privately owned microwave system.



SUPERVISORY CONTROL panel for Red Mesa tank farm. Fig. 1.

tion, and at Cameron, the first intermediate station. Twentynine Palms, the second intermediate station, has two units. All stations are designed for an ultimate of five units.

At Cameron and Twentynine Palms the pumping units have weather-protected motors and are installed outdoors. Switchgear and control equipment are housed in a control building apart from the pump slab. This design provides the maximum in safety for an unattended station. Future stations will also be of this type.

At Red Mesa the pumping units are installed indoors because of severe climatic conditions. Motors are of the forced-base-ventilated design and positive pressure differential is maintained between the pump room and control rooms.

The switchgear at all stations is of the standard indoor metal-clad type with drawout air-break circuit breakers. The reactor method of reduced voltage starting is used for the main pump motors requiring three cubicles for each motor starter. Sequencing and protective relays and unit valve starters are installed in or on switchgear cubicle extensions thus making for unitized motor starters and reducing the number of interconnecting conduits and associated wiring.

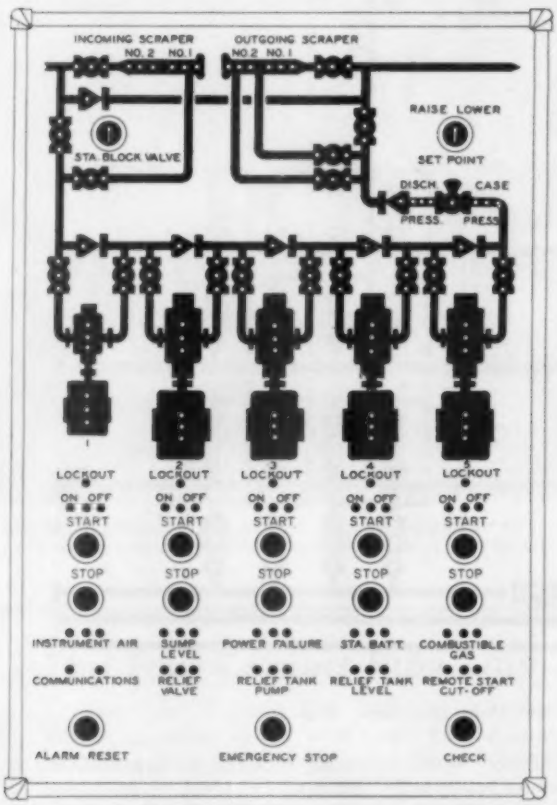
The units are equipped with the necessary sequencing relays to provide semiautomatic operation. The unit starting sequence is as follows:

1. Push start button momentarily.
2. The pump vent valve opens and at the same time the unit suction valve starts to open.
3. When the suction valve is one-half open the pump vent valve closes.
4. When the suction valve is fully open the starting breaker closes and the pump motor starts (approximately 60 seconds after pushing the start button).
5. After preset starting time, the running breaker closes, tripping the starting breaker, and the discharge valve starts to open.
6. Discharge valve open and sequence complete in approximately 2 minutes.

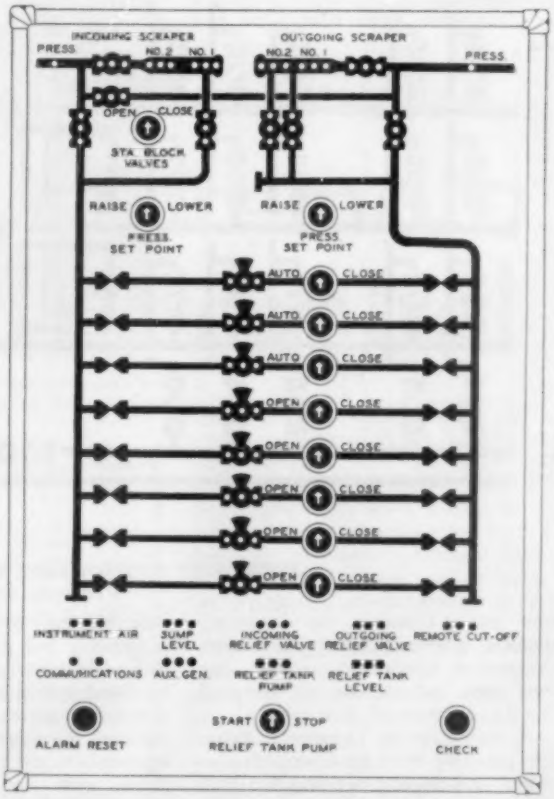
The station auxiliary equipment and scraper-trap valves are served from a central motor-control center located in the switchgear room. A local control cabinet is installed in the operating room for use during communication outages or other emergencies.

Pneumatic control valves regulate line pressures. The pneumatic control system includes suction pressure, discharge pressure, flow and kilowatt-demand controllers. The discharge-pressure controller is equipped with a set-point changing device enabling it to be remotely set.

Red Mesa, being the initial station and receiving crude oil from the two feeder lines, has four 55,000-bbl. storage tanks each equipped with 25-hp. tank mixers, automatic remote-reading tank gages, and averaging thermometers. A tank manifold with motor-operated valves is provided for remote switching of the incoming and outgoing lines. Two outdoor 150-hp.



PUMP STATION supervisory control panel. Fig. 2.



PRESSURE-REDUCING station supervisory control panel. Fig. 3.

vertical centrifugal booster pumps furnish station suction pressure.

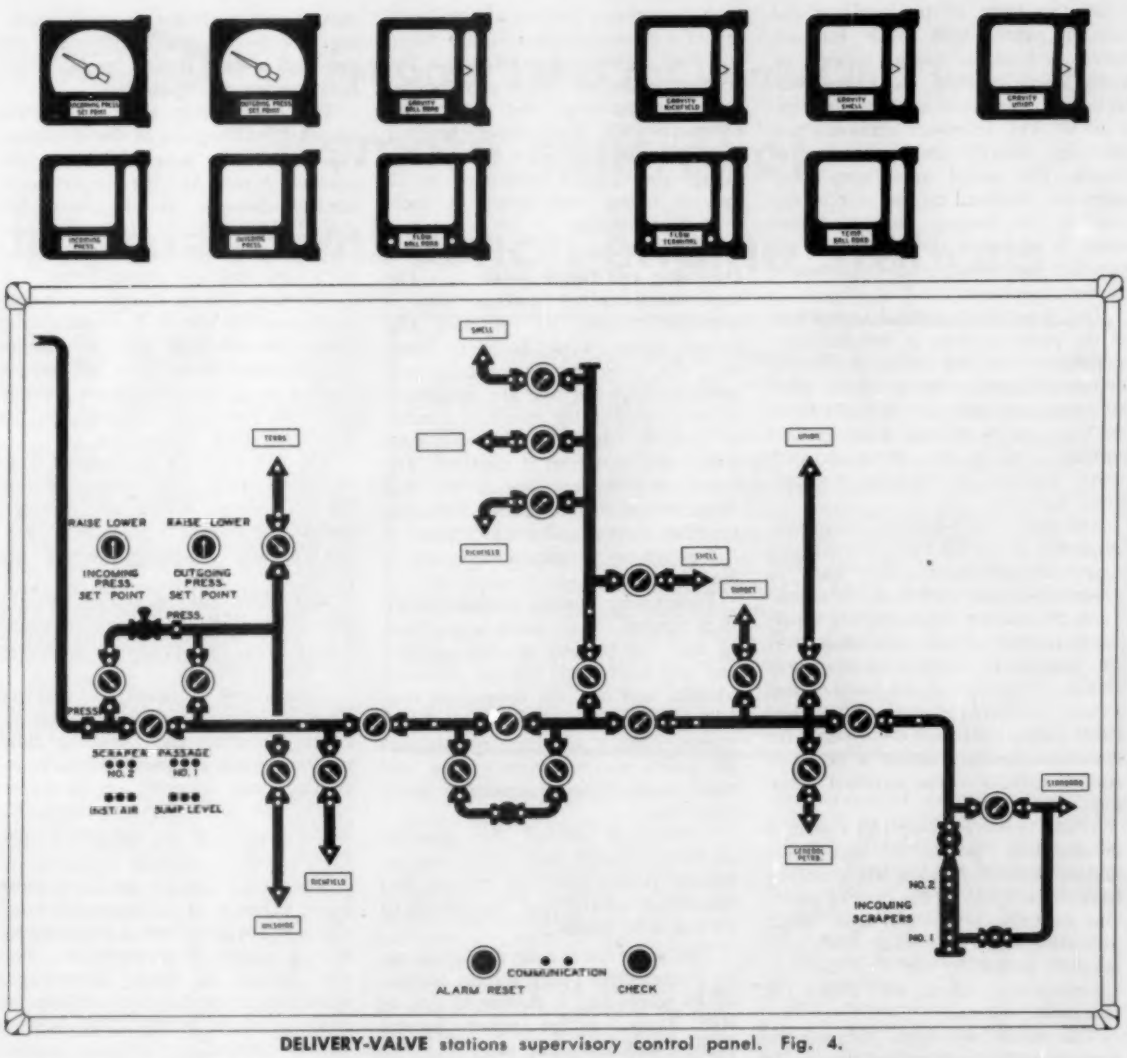
Local Protective Features

For successful and safe operation, an unattended station must be completely self-protected on a local basis independent of the supervisory-control system. The stations on the Four Corners line are equipped with a full complement of local protective devices.

The unit protective functions are divided into two general categories. Those of a temporary nature are classified "nonlockout" while those of a more permanent nature, probably requiring equipment repairs to correct, are classified "lockout." Upon operation of a nonlockout device, a unit is tripped but can subsequently be restarted either locally or remotely after the tripping device has reset.

Upon operation of a lockout device a relay type switch is tripped which must be manually reset before the unit can be restarted. The unit protective functions are subdivided into two additional categories of "electrical" and "mechanical" for supervisory indication at the controlling point. The unit protective devices are listed below:

1. Electrical nonlockout
   a. Motor winding temperature
   b. A.c. undervoltage
   c. Thermal overload (long time)
2. Electrical lockout
   a. Phase balance
   b. Overcurrent
   c. Thermal overload (instantaneous)
3. Mechanical nonlockout
   a. Pump-case temperature
   b. Pump-case pressure
   c. Pump suction pressure
4. Mechanical lockout
   a. Motor inboard bearing temperature
   b. Motor outboard bearing temperature
   c. Pump inboard bearing temperature



DELIVERY-VALVE stations supervisory control panel. Fig. 4.

d. Pump outboard bearing temperature
e. Unit vibration
f. Seal leakage

Since the unit protective functions are grouped for supervisory indication, manual reset annunciators are provided with individual drops for each function.

Various station protective devices are also provided. High station case pressure shuts down the first two units and high outgoing line pressure shuts down all three units. The main circuit breaker is arranged to trip on abnormal voltage or phase sequence, but will automatically reclose when the conditions return to normal. Overcurrent will trip and lockout the breaker.

Pressure-Reducing Stations

An unusual feature of this pipeline is the two pressure-reducing stations required because of the great differences in ground elevation along the pipeline route. The line varies from a maximum elevation of 15 ft. in Los Angeles County to a maximum elevation of 6,690 ft. at Marsh Pass. At Kingman and Corona, the two pressure-reducing stations, the downstream pressure is controlled so that the maximum safe operating limit of the pipe is not exceeded at points of low elevation.

Pressure reduction is accomplished by flowing the oil through a group of four parallel friction tubes. Each friction tube consists of a section of 2 or 2½-in. pipe 65 ft. in length with three sections of ¾ or 1-in. tubing welded inside the larger pipe. A pneumatic control valve is installed in series with each friction tube, and the first three tubes are automatically operated by incoming pressure, outgoing pressure, and flow controllers.

Three additional pipe sections with control valves, but less friction tubing, are arranged in parallel with the friction tubes, and they, along with the fourth friction tube, are placed in or out of operation according to line conditions.

The Los Angeles terminal building is the central control point for the entire pipeline system. The supervisory control equipment in the terminal building is mounted in upright cabinets which will with ultimate expansion comprise three walls of the dispatcher's office.

Generally one cabinet is required for each station although all the valve stations in the Los Angeles area require only one cabinet and Red Mesa station with its booster pumps and tank manifold requires three cabinets. The cabinets are arranged in order according to the actual layout of the pipeline.

On the front of the cabinets are control panels with push buttons, lights, and mimic piping layouts of lines, valves, pumps, etc. being controlled or supervised, as shown in Figs. 1 to 4. The telemeter receivers are mounted directly above the control panels. The sealed supervisory relay cases are mounted on the rear of the cabinets on hinged panels. Access space is provided at the rear of the cabinets for testing and maintenance of the equipment.

The supervisory-control equipment at the pump stations is installed in a switchgear auxiliary cubicle at one end of the switchgear line-up; at the pressure-reducing stations it is installed on the rear panel of the local control cabinet; and at the seven delivery valve stations in outdoor weatherproof cabinets.

The supervisory-control equipment employed is an all relay pulse-count type with automatic check back to prevent incorrect operations or indications. A separate and complete supervisory-control system operating over an individual duplex audio tone channel is provided for each pump station, pressure-reducing station, and valve station, although the systems for the valve stations utilize a common control cabinet in the terminal building.

Each supervisory-control system is divided into "points" of supervision and/or control. A point will generally have three lights on the control panel. One of these is a white light which indicates that the point has been selected, either by the dispatcher or automatically when an alarm or change is reported.

The other two lights indicate the position of the supervised device. In the case of an alarm function these are green (normal) and red (alarm). In the case of a valve the lights are green (valve closed), amber (valve open), and green and amber (valve in intermediate position).

Any change in position of a supervised device is automatically reported to the controlling point. In the case of an alarm-type function the light change on the control panel is accompanied by the sounding of an audible alarm. The audible alarm is silenced by pushing the alarm reset button. A change in position of a device of a nonalarm type or a change initiated by the dispatcher is not accompanied by an audible alarm.

A master check button is provided which upon being operated will cause the supervisory to check each point in sequence. Each point when checked will momentarily light its associated white light.

In case of communication failure, each supervisory system affected will report a communication failure alarm and hold its indications of station operating conditions. After communications are restored, the supervisory equipment will automatically correct any indications in error. During the outage the stations will continue to operate unless shut down by local protective devices.

Operating and future points . . . The supervisory-control systems have a specified number of operating and future points. Push buttons, lights, etc., are provided for existing and specified future points. The equipment is not limited to the specified number of points, however, and additional points can be added if required. The supervisory control system for Red Mesa station has 97 points including specified future, and could expand to 175 points with ultimate expansion of facilities.

Supervisory control provides start-stop control of all units, supervision of unit valves, unit breaker position and unit mechanical trouble, electrical trouble, and lockout, open-close control and supervision of scraper-trap valves, control of discharge-pressure set point, and emergency stop and supervision of various station alarm functions.

Supervisory control also provides start-stop control and supervision of booster pumps and tank mixers, and open-close control and supervision of all manifold valves.

The supervisory-control system for an intermediate pump station consists of 49 points and is similar to that of Red Mesa, except fewer booster pumps, tank manifold, etc.

A pressure-reducing station requires 29 points for the following functions: control and supervision of friction tubes and pipe sections, control of incoming and outgoing pressure set points, control and supervision of scraper-trap valves, control and supervision of injection pump, and supervision of station alarm functions.

A supervisory system for a valve station generally has two or three points and provides control and supervision of the valves and supervision of pressure and flow alarms where required.

Telemetering and Tank Gaging

The telemetering equipment is of the impulse duration type with a 5-second period. Each telemetered quantity is transmitted on a continuous basis over a simplex audio tone channel. The telemeter transmitters are generally of explosionproof design grouped outdoors on a common rack. Local telemeter receivers working directly off the transmitters are provided at each station for use when local control is required.

The telemetering receivers at the terminal building are of the miniature type and are installed above the control panels in the supervisory-control cabinets, as previously discussed. The majority of the receivers are recording and some are equipped with high and low alarm lights.

The telemetering equipment is self-synchronizing and will automatically correct its readings upon restoration of communications after an outage. During an outage all receivers affected will read full scale indicating to the dispatcher their inoperation.

The following are telemetered from an intermediate pump station: station suction pressure, station case pressure, station discharge pressure, flow, gravity, and discharge-pressure set point.

Red Mesa has, in addition to the above, the flows of the two incoming feeder lines, and pressures related to the booster pumps.

Telemetered quantities received from a pressure-reducing station include incoming and outgoing flow, incoming and outgoing pressure, incoming and outgoing pressure set point, and gravity. Also telemetered is the position of the automatic tube-bundle control valve in operation.

Since only one of the three automatic valves is in an intermediate position at any one time, a single telemetering system with automatic selection serves all three. Telemetered quantities from the valve stations include pressure, gravity, and flow at various points.

A remote-reading tank-gaging system is provided for the storage tanks at Red Mesa and the relief tanks at Kingman and Corona. Each tank is equipped with liquid-level gages and averaging thermometers. Two receivers are installed, one at Red Mesa station and one at the Los Angeles termimal building. The entire system works on a party-line basis and readings from all tanks can be taken at either receiver.

The system employed is of the pulse-code type. Transmitted information is digital rather than analog, thus eliminating the possibility of errors being introduced by the transmission system. To take a reading, the dispatcher dials the function and tank desired by means of a conventional telephone-type dial. After about 5 seconds, a reading appears on a visual read-out panel giving the tank number and liquid level or temperature. Liquid-level high and low alarms are automatically reported.

Special Report

What Great Lakes has learned in 3 years about

Remote control of internal-combustion-engine stations

BY P. R. MADDEN
Electrical Study Engineer
Great Lakes Pipe Line Co.

The pattern of modern thought in industry has led to the emergence of automatic and remote controls for pump drives. In recent years, crude oil and refined product pipeline operating companies have adopted the use of remote control for pumping stations. This practice, although not new, has received widespread response within the petroleum industry. The practices vary from remote control of entire systems to confinement of control to intermediate or booster stations, often termed "satellite." Operating procedures also vary, from the use of "attended" to "completely unattended" stations. One factor, however, common to most companies, has been the adaptation of electric-motor drives for pumps. Great Lakes Pipe Line Co. has constructed and placed in operation a number of remote-controlled, all-electric, completely unattended pumping stations, and now is operating a remote-controlled internal-combustion-engine station.

IN 1955, Great Lakes Pipe Line Co. developed the design for a remote-controlled internal-combustion engine station. The station was constructed and placed on stream in December 1956. The facility, located at Topeka, Kans., operates a 10-in. products line extending from El Dorado, Kans., to Kansas City, Kans. The engine is a full-diesel type and is controlled from El Dorado some 105 miles distant. This station is completely unattended matching the operating procedure of the motor-driven all-electric facilities.

Problems Involved

The basic mechanical, electromechanical, pneumatic, and hydraulic components for operation of a diesel-engine station are essentially the same whether locally operated or controlled from a distant location. This statement may also be applied to an all-electric station. The problems for remote control consist principally in the adaptation of control equipment that will permit normal pipeline operating methods with a high safety factor, while maintaining a reasonable investment cost.

The problems surrounding the design of an internal-combustion engine station, remote controlled, are enumerated in these questions:

1. What are the economics when considering internal-combustion engines vs. electric drives for pumps?
2. Must the internal-combustion engine be specially built with certain auxiliary equipment provided and installed by the manufacturer?
3. Are the control devices and equipment special or standard manufactured items?
4. What are requisites for remote-control channels between the controlling and controlled station?

Questions of a conventional or routine nature that are common to the engineering of all pump stations have been ignored. The four questions posed above lead directly to projection of remote control to internal-combustion engine stations.

Economic Consideration

In the original analysis of costs for the Topeka station on the basis of engine versus electric-motor drive, the investment cost favored the electric motor. The estimated cost of the motor drive was 65% of the investment for an engine.

The operating-cost analysis indicated use of the engine over the electric motor. Factors considered were the availability of the electric power, electric-power rates, operating hours, etc., opposing diesel-fuel costs, maintenance, etc.

Once the necessity of the pump station is established, the economic problem can be resolved only through a detailed cost comparison of the types of pump drives. The comparison treated each station individually. In the method of cost analysis used by the engineering department of Great Lakes, the engine proved to be more economical for the Topeka installation.

Internal-Combustion Engine

The engine used at the Topeka station is a six-cylinder 9 by 10½ diesel rated 800 b.hp. It drives a 6 by 8 by 11 four-stage horizontal centrifugal pump through a 925 to 3,600-r.p.m. gear arrangement.

The engine itself is not special but by virtue of ordering auxiliary equipment mounted by the engine manufacturer and in some instances mounting equipment furnished by Great Lakes, it might be placed in the special classification. This method for providing part of the auxiliary equipment is not a necessity but rather an expedient. The starting, cooling, and lubricating systems are adaptable to almost any diesel engine used in pipeline pumping.

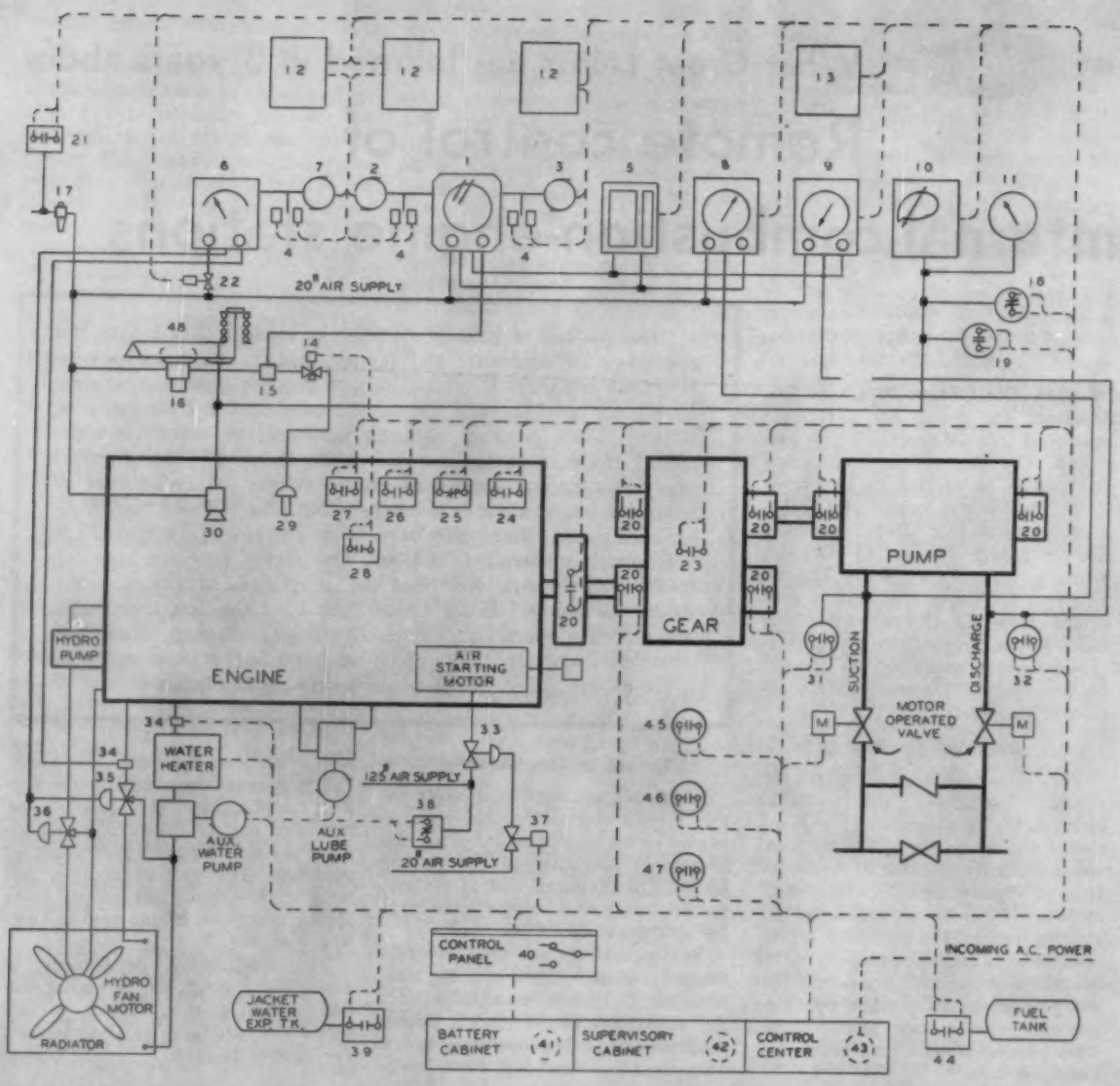
The engineering department of Great Lakes holds the viewpoint that any of their existing engines, as well as the new additions, can be equipped for remote control.

Controls

The trend in control development and manufacture has reached a stage where devices or equipment may be readily obtained for the remote control of an electric-motor-driven pump. The engineer has a choice in selecting equipment for the design. Also, the equipment has been proven by months or years of actual operation.

For remote control of an internal-combustion engine, the above statements are indirectly opposite. Although remote control of the engine has been considered for some time, it is only recently that development has become actual, and then in isolated cases. As a result, the necessary control equipment has not been produced to meet the more extensive requirements of the internal-combustion engine.

Early stages of design for the



1 PNEUMATIC PRESSURE CONTROLLER
2 GEAR-HEAD MOTOR, SUCTION CONTROL
3 GEAR-HEAD MOTOR, DISCHARGE CONTROL
4 LIMIT SWITCHES - RAISE AND LOWER
5 STRIP CHART RECORDER
6 TEMPERATURE CONTROLLER
7 GEAR-HEAD MOTOR, TEMPERATURE CONTROL
8 SUCTION PRESSURE TRANSMITTER
9 DISCHARGE PRESSURE TRANSMITTER
10 ENGINE SPEED TRANSMITTER
11 TACHOMETER
12 REVERSING SWITCHES - MOTOR CONTROL
13 STARTING CYCLE COUNTING SWITCH
14 VALVE-EMERGENCY SHUTDOWN
15 VALVE-HIGH PRESSURE SELECTOR
16 AIR PRESSURE REGULATOR
17 SUPPLY AIR PRESSURE REGULATOR
18 SWITCH - CLOSES ON SPEED REDUCTION
19 PRESSURE SWITCH - CLOSES AT 50 AIR
20 BEARING TEMPERATURE SWITCHES
21 PRESSURE SWITCH - CLOSES ON LOW AIR
22 SOLENOID VALVE - TEMPERATURE CONTROL
23 GEAR OIL TEMPERATURE SWITCH-HIGH
24 LUBE OIL TEMPERATURE SWITCH - CLOSE AT 50°F.
25 PRESSURE SWITCH - LOW LUBE OIL
26 SWITCH - WATER TEMPERATURE
27 SWITCH - HIGH WATER TEMPERATURE
28 TEMPERATURE RELAY - DIFFERENTIAL EXHAUST
29 DIAPHRAGM ACTUATOR FOR FUEL PUMP RACK
30 PNEUMATIC SPEED TRANSMITTER
31 PRESSURE SWITCH - CLOSES ON LOW SUCTION
32 PRESSURE SWITCH - CLOSES ON HIGH DISCHARGE
33 STARTING AIR VALVE
34 TEMPERATURE DETECTOR
35 DIAPHRAGM OPERATED VALVE-FLOW CONTROL
36 DIAPHRAGM OPERATED VALVE-FAN CONTROL
37 PILOT VALVE - STARTING AIR
38 PRESSURE SWITCH-AIR, OPEN 100# - CLOSE 150#
39 FLOAT SWITCH - WATER LEVEL
40 REMOTE-LOCAL, CONTROL CUTOFF SWITCH
41 D.C. UNDERVOLTAGE RELAY
42 LOCKOUT RELAY
43 A.C. POWER FAILURE
44 FLOAT SWITCH - FUEL LEVEL
45 HAZARDOUS GAS DETECTOR
46 HAZARDOUS GAS DETECTOR EQUIP. FAILURE
47 FLOAT SWITCH - SEAL SUMP
48 IDLE SPEED CONTROLLER

——————— PNEUMATIC AND HYDRAULIC CONNECTIONS
— — — — — ELECTRICAL CONNECTIONS

STATION COMPONENTS are shown in single-line diagram. Fig. 1.

Topeka station resolved into diagrams similar to Fig. 1, "Single Line Diagram of Station Components," and Fig. 3, "Basic Schematic Diagram of Controls." With the above formulations satisfying all conditions, detailed design of devices, equipment, and connections were produced.

Since the controls represent the major problem for station development, a number of the devices will be described together with one of the controlling operations of the station.

Supervisory Equipment

The supervisory equipment at Topeka is the same type used by Great Lakes Pipe Line for remote-controlled all-electric stations. This is a coded-pulse system using standard telephone-type relays for transmitting and receiving signals. The interposing and auxiliary relays are of standard heavy-duty contact type. This equipment is installed in two cabinets with one cabinet mounting a front panel for containing annunciator and meters. The cabinets are located in the control room, a nonhazardous area. Fig. 2 shows photograph of the supervisory cabinet with control panel (front view) at the controlling station, El Dorado.

Table 1 represents the control, supervision, and telemetering functions for the diesel pumping unit.

The supervisory equipment itself presents no problem. The problem develops when selecting devices or equipment for control and supervision that will satisfactorily coordinate with the supervisory.

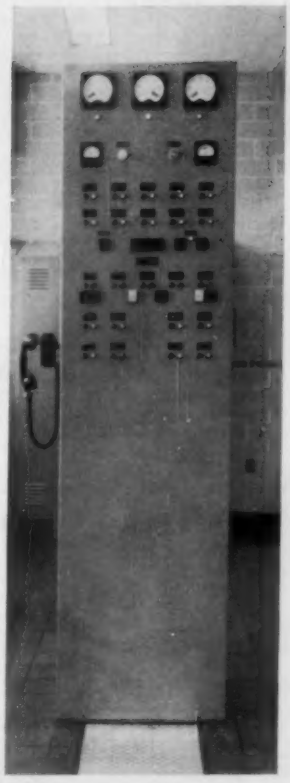
Station Operating Equipment

The pump-station components directly associated with control and supervision are shown on Fig. 1. A summary of these components, Table 2, presents a reference as to the availability, modifications, and development necessary.

The majority of the items, Table 2, are included as "standard manufacture." To eliminate any misunderstanding, availability is the least problem. Much time was consumed in the preliminary design for selecting available devices to fit the complex pattern of control and supervision.

Items classified as standard manufacture range from the commonly used temperature - detection switches, solenoid valves, etc., to the principal controller which was further modified by Great Lakes. Devices requiring modification and those designed by Great Lakes will be described now.

The pneumatic pressure controller, the principal control device No. 1, Fig. 1, is a double-duty instrument.



SUPERVISORY CABINET with control panel. Fig. 2.

The controller has two pressure-measuring elements, one nozzle-and-baffle assembly and one pneumatic-control unit. Modifications include an arrangement whereby either the suction or discharge pens can position the baffle through a special linkage.

Further modifications include an arrangement for positioning the suction set point remotely from El Dorado. The operator may vary the set point by depressing push bottons (raise or lower) and holding until desired point is reached.

Upon operating the push button, a transmitted signal will be recognized by a supervisory interposing relay at Topeka which in turn permits energization of an auxiliary relay. The auxiliary-relay contacts control the reversing gearhead driving motor to raise (or lower) the suction set point. Associated limit switches restrict travel establishing a pressure range.

On startup, the engine is operating at idle speed. At proper jacket-water temperature, a switch will close energizing an auxiliary relay. The relay contacts control the gearhead driving motor moving the discharge set-pointer up scale. For normal shutdown, the "stop" condition is originated at El Dorado.

An auxiliary relay is energized through the supervisory interposing relay. The auxiliary-relay contacts control the gearhead driving motor moving the discharge set-pointer down scale. As in the suction side of the controller, limit switches restrict travel establishing a pressure operating range.

The temperature controller, device No. 6, Fig. 1, is modified with the additions of a gearhead motor and limit switches. In normal shutdown, an auxiliary relay is energized through the same means and simultaneously with the discharge pressure control. The auxiliary - relay contacts control the gearhead driving motor lowering the temperature-control point with the limit switches restricting the range of travel.

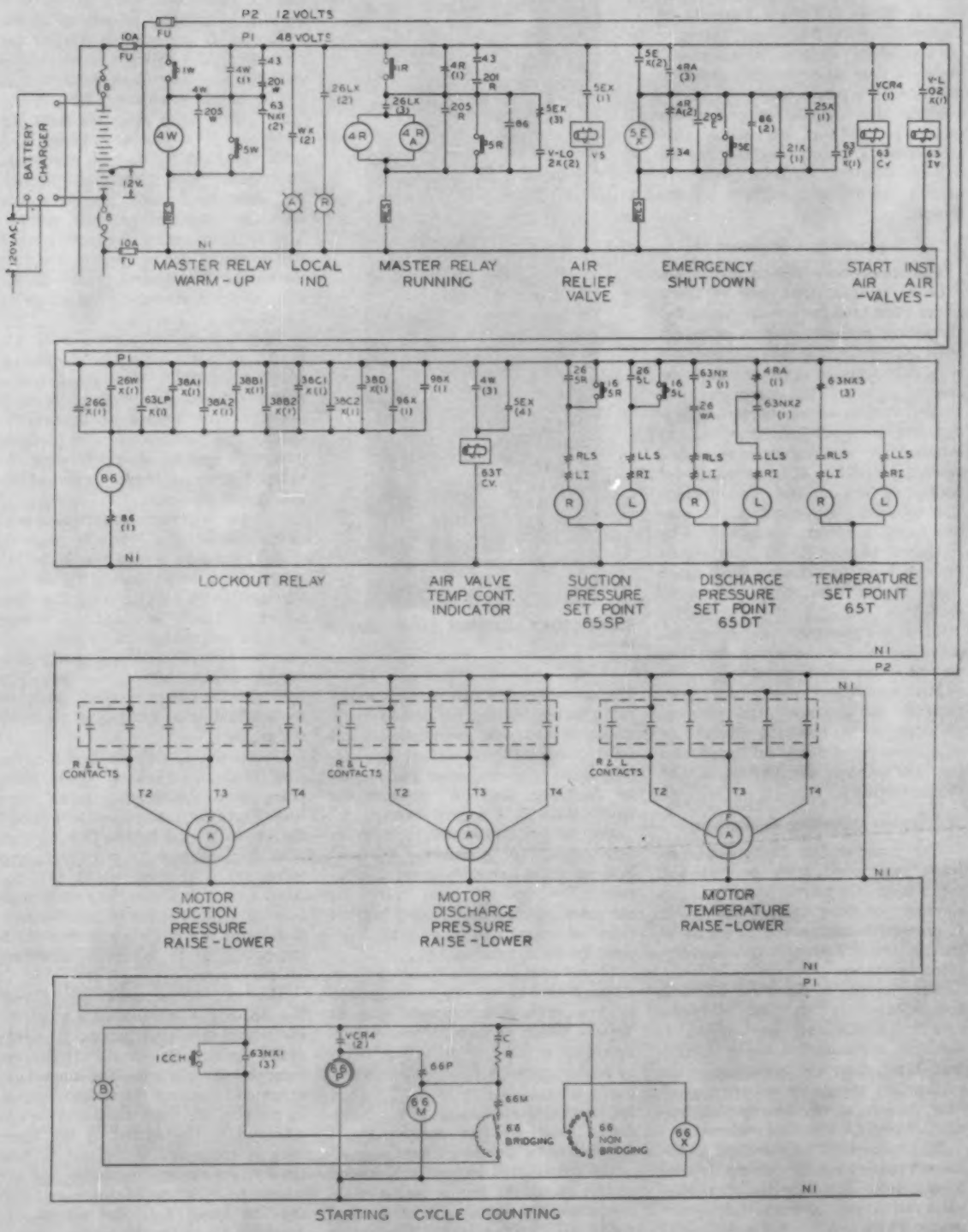
The tachometer, device No. 11, Fig. 1, is connected to the pneumatic speed transmitter. The speed transmitter delivers air pressure proportional to the square of the engine speed. The tachometer is a pressure gage with appropriate r.p.m. scale developed from a curve furnished by the manufacturer.

The starting cycle counting switch, device No. 13, Fig. 1, is a 26-position, 4-deck stepping switch. It is arranged and wired for five "starting attempts" with locking after the fifth attempt. Upon locking, the switch must be returned to its original position or "homed" with a separate push button. When starting, the sequence operation of other devices leads to the application of starting air to crank the engine.

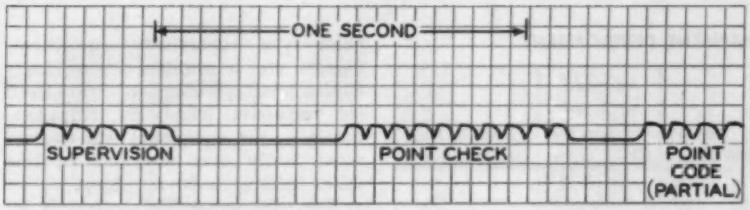
If the engine fails to start on the first attempt, cranking again takes place upon rebuilding of the air pressure. Each starting attempt will "step" the switch. If the engine fails to start after five attempts, a starting failure indication is received at El Dorado. Also, a lamp indicates the switch position on the Topeka control panel. Successful starting before the fifth attempt leads to automatic resetting of the switch.

The idle speed controller, device No. 48, Fig. 1, consists of a modified instrument-type air regulator. The regulator spring acts on the diaphragm through a lever system. The diaphragm mounted to oppose the spring receives its air pressure from the engine-speed transmitter. The output of the regulator is connected to the engine fuel control. As the engine speeds up, the transmitted air output increases with the idle speed controller output decreasing to slow the engine down. Tension on the spring adjusts the speed of the engine.

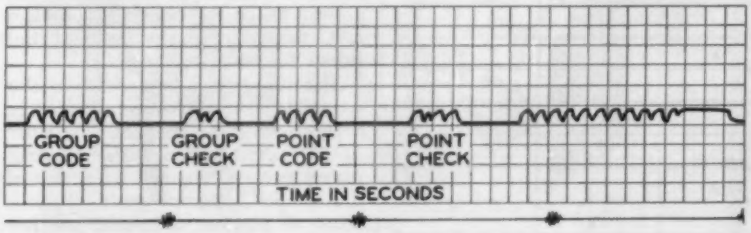
For monitoring engine-exhaust temperature, the standard thermocouples were used in conjunction with meter relays, device No. 28, Fig. 1. With



BASIC SCHEMATIC diagram of controls. Fig. 3.



SATISFACTORY CONDITION is indicated for supervisory pulse shown. Fig. 4.



UNSATISFACTORY CONDITION indicated would prevent completion of supervisory function. Fig. 5.

equal thermocouple temperatures, their outputs oppose and there is no current flow. With either a high or low temperature on any cylinder, the unbalance will operate one of the relays indicating the condition through the supervisory to El Dorado.

For an insight into the wiring requirement for the above controls, refer to Fig. 3.

Station Power and Control Circuits

The station auxiliaries, motor-operated valves, air compressor, water heater, etc., are served by a 120/208-volt four-wire power system. The supervisory and associated controls are connected to a 48-volt d.c. system using battery power.

In the event of a.c. power failure there is no immediate effect and the engine may be permitted to run approximately 2 hours after failure occurs. The reason for this is: (1) the controls operate from battery power, (2) air is stored for approximately 2 hours of station operation, (3) the engine cooling is by means of a hydraulic system. This interval of time permits a workman to travel to the station for inspection, corrective measures, or shutdown purposes if necessary. Also, a number of electric-power failures are of a class that permits restoration of service in less than 2 hours.

Operation by Remote Control

The functioning of controls for a remote-starting operation is presented in the following. The description is based on the winter season requiring a warmup cycle before starting. Device numbers used are those shown on Fig. 1 Italic type indicates the controlling station functions.

Control Operation-Remote Start

Remote-local switch No. 40 in the remote position.

Warmup cycle . . .

Operation "on" push button at El Dorado. Energizes interposing relay. Interposing relay contact energizes "warmup" master relay. A master-relay contact energizes contactor coils for the auxiliary water pump, auxiliary water heater, and auxiliary lube-oil pump. A master relay contact energizes solenoid No. 22, opening valve in air line to temperature controller. Auxiliaries "on" *indicated with amber lamp at El Dorado.*

A temperature detector will automatically control the "warmup" auxiliaries in the event engine start is delayed.

Engine start . . .

Operate "start" push button at El

TABLE 1—CONTROL, SUPERVISION, AND TELEMETERING

Sup. Point No.	Function	Operation	Condition
1	Control	Suction Pressure	Raise or Lower
	Supervision	Suction Pressure	Low or Normal
		Engine Speed	Continuous Telemetering
2	Supervision	Discharge Pressure	High or Normal
		Discharge Pressure	Telemetering
3	Supervision	Instrument Air	Alarm or Normal
4	Supervision	Starting Air	Alarm or Normal
5	Supervision	A.C. Phase Failure	Alarm or Normal
6	Supervision	Fuel Tank Condition	Excess or Normal
7	Supervision	Hazardous Gas	Alarm or Normal
8	Supervision	Battery	Low or Normal
9	Supervision	Hazardous Gas Equip.	Failure or Normal
10	Control	Warmup	Start or Stop
	Supervision	Warmup	Auxiliaries on
11	Supervision	Warmup	Oil Satisfactory
12	Control	Emergency	Stop
	Supervision	Suction Valve	Close or Open
13	Supervision	Discharge Valve	Close or Open
	Control	Engine	Start or Stop
14	Supervision	Start Failure	Alarm or Normal
15	Supervision	Engine	Stop or Run
		Suction Pressure	Telemetering
16	Supervision	Water Temperature	High or Normal
17	Supervision	Exhaust Temperature	Alarm or Normal
18	Supervision	Bearing Temperature	High or Normal
19	Supervision	Gear Oil Temperature	High or Normal
20	Supervision	Oil Pressure	Low or Normal
21	Supervision	Sump Seal	High or Normal
22	Supervision	Cutoff Switch	Remote or Local
23	Supervision	Lockout Relay	Alarm or Normal

TABLE 2—SUMMARY OF EQUIPMENT DEVELOPMENT

Item No.*	Standard Mfd. Item	Mfr. Special Features	Additions by Great Lakes	Adapted to Other Devices by Great Lakes	Designed by Great Lakes
1	X	X	X		
2, 3, 7	X			X	
4	X			X	
5	X				
6	X	X	X		
8	X				
9	X				
10	X	X			
11	X		X		
12	X			X	
13					X
14-27	X				
28					X
29-39	X				
40	X		X		
41-48	X				

*For number reference see Fig. 1, Single Line Diagram.

Dorado. Energizes interposing relay. Interposing relay contact energizes "engine start" master relay. Master relay contacts energize the motor-operated-valve contactor coils and valves start to open.

Full opening of the suction and discharge valves will:

1. *Indicate position of valves at El Dorado. Blue lamps—off, amber lamps—on.*

2. Valve limit switches close energizing solenoid No. 21 and valve opens in station instrument air line. With normal starting air of 125 psi., pressure switch No. 38 closes energizing an auxiliary relay. The auxiliary relay contact energizes solenoid No. 37 opening pilot valve in 20-psi. air line. The 20-psi. air opens the diaphragm valve No. 33 in the starting air line and the engine is cranked. Each starting attempt moves the counting switch, No. 13, one position.

The engine starts and condition is *indicated at El Dorado. Blue lamp—off, amber lamp—on.*

When engine starts, speed transmitter No. 30 produces air pressure "P." This pressure will close switch No. 19, energizing auxiliary relays. Auxiliary relay contacts will:

1. Deenergize solenoid No. 37 closing valve in 20-psi. air line and with loss of air, diaphragm valve No. 33 in the starting air line will close.

2. Deenergize "warmup" master relay. Relay contact opens control circuit disconnecting the auxiliary water heater, auxiliary water pump and auxiliary lube-oil pump. Auxiliaries "off" is *indicated with amber lamp dark at El Dorado.*

3. The starting cycle switch is "homed" to its original position.

4. The idle speed controller No. 48 is positioned by air pressure from the engine-speed transmitter No. 30.

At proper jacket-water temperature (°F.), temperature switch No. 26 closes energizing an auxiliary relay. The auxiliary relay contact controls a driving motor on the discharge side of the pneumatic pressure controller, No. 1, moving the discharge set point up scale. When the output air pressure of the pneumatic controller exceeds the output of the idle-speed controller, engine control is transferred to the pneumatic pressure controller and the engine enters the normal operating range.

Suction pressure associated with the pneumatic pressure controller is regulated remotely *from El Dorado by operating "raise" or "lower" push buttons.*

In addition to the normal "stop" operation, an emergency "stop" condition is built into the controls.

The station can be operated locally by changing the position of switch No. 40 from "remote" to "local" and operating the push buttons provided.

As previously stated, Great Lakes Pipe Line Co. uses all-relay coded-pulse-type supervisory equipment. Signals are transmitted over half-duplex telegraph channels leased from the respective telephone companies. Basically, the equipment will operate satisfactorily over any pair of line wires forming a 60 ma. loop.

The telegraph-grade channel is restricting in that but one function can be transmitted at a time. This has proven to be no operating problem and, too, signals are not lost but stored for later reporting.

The supervisory equipment is also adaptable to a microwave channel or a telephone-grade channel. The latter facility costs (leased basis) approximately two and one-half times that of the simple telegraph-grade channel. Since all pipeline companies use privately owned or leased communication facilities in their operations, the remote-control channel does not present a problem.

Fig. 4 is the reproduction of an oscillograph recording representing part of a "check code." The pulses shown indicate a satisfactory condition and would permit completion of a supervisory function.

Fig. 5 shows an unsatisfactory pulse condition which would not result in completion of a function. In this example the control channel was tested at both ends verifying the fact that the abnormality was not in the Great Lakes equipment but in the telephone company's system. The abnormality was cleared in about half an hour.

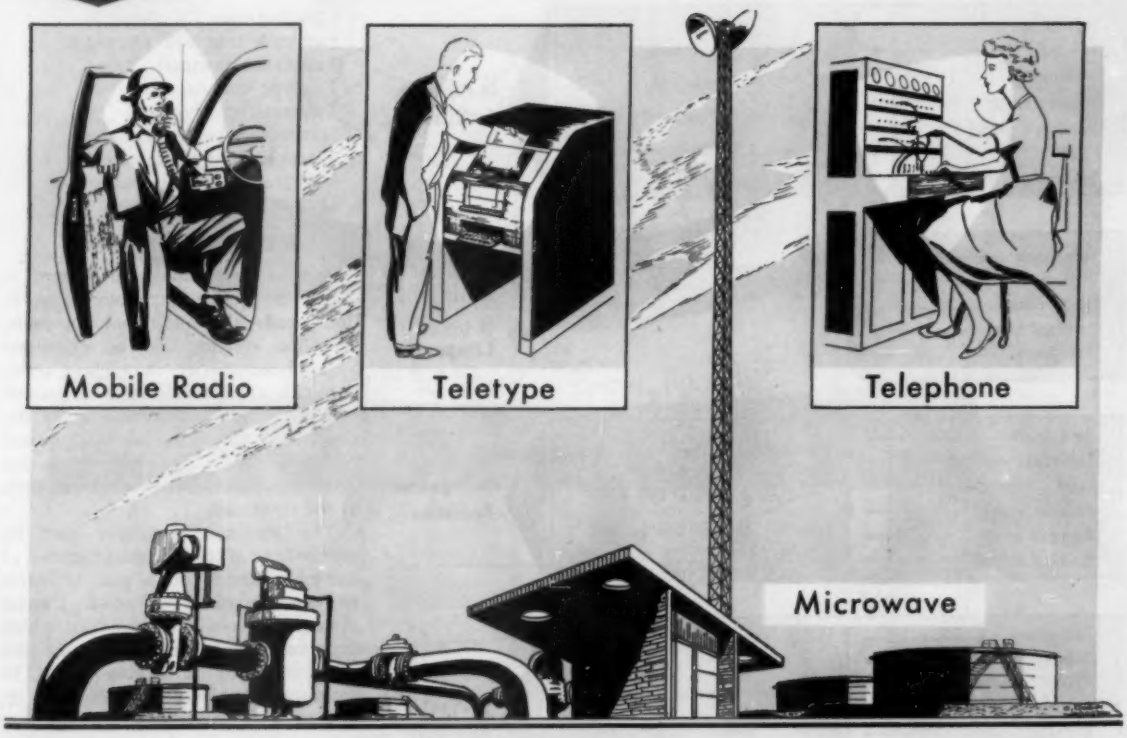
The above exhibits were produced by a strip-chart recorder. The instrument is used by Great Lakes for periodic channel testing as well as trouble-shooting purposes. The transmitted pulses produced by this particular supervisory equipment are in a frequency range of 15 per second.

Summary

Five years ago, no serious consideration had been given to the remote control of internal-combustion engines. Preliminary investigation revealed that far more problems would exist than those surrounding the development of the electric-unit station, which is readily adaptable to remote control. With the design, construction, and successful operation of the unattended Topeka engine station in 1956, these problems have been reduced both in number as well as magnitude.

Today these problems might be cataloged as follows: (1) economic; (2) design, development, and modification of control equipment. With the development and marketing of certain controls, problem (2) could be eliminated.

Special Report



TODAY'S PIPELINES own and operate more than 400,000 channel-miles of communication circuits, not counting their mobile units—about 70% of the total communications they use.

What's new, and what are the trends in Pipeline communication?

"The limits of application can very well be described in terms of tomorrow's imagination."

BY C. L. MOON
Engineer Senior Grade, Electrical Section, Service Pipe Line Co.

TECHNOLOGICAL advances have increased the need for more efficient communication between people and the machines which power today's pipelines. Communication has become so important and traffic so heavy that pipeline companies have found it advisable to have their own private systems and supplement them with whatever common-carrier facilities are needed.

The communication engineer is finding an increasing variety of tools to handle transmission of intracompany written records, routine messages, and actual pipeline operations for controlling pump units and data logging.

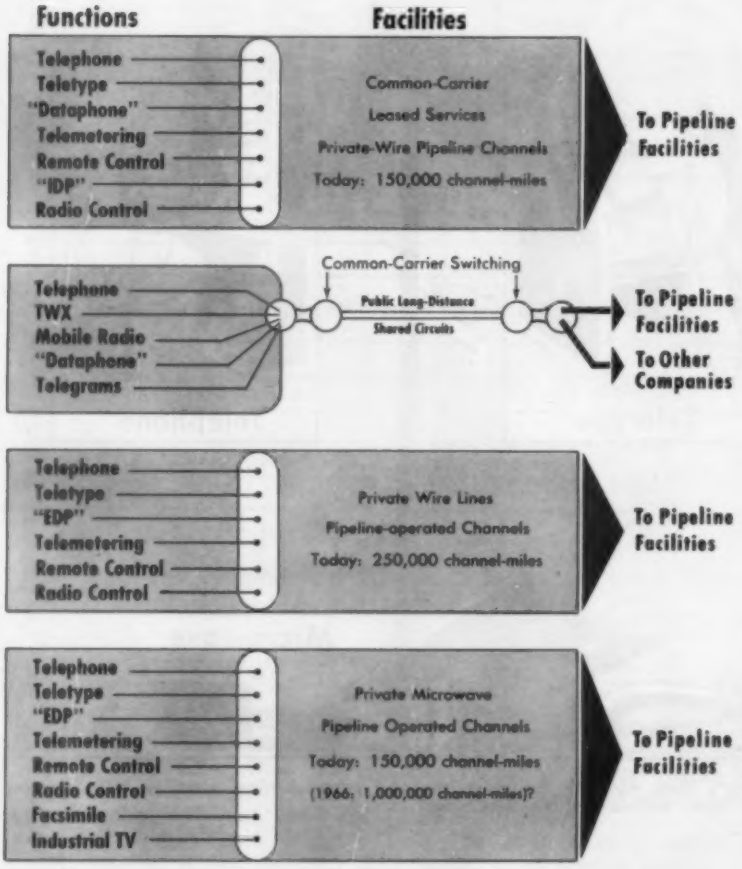
Teletypes may be set up for high-speed transmission of statistical data into the main office from punched cards or perforated tape in the field ("IDP" or integrated data processing). A new telephone-company service, to be available in the near future, is high-speed transmission of data and text over regular telephone lines. Called "Dataphone," it is a modified IDF application, handling data at 800 to 1,300 words per minute. One model stores information on magnetic tape from a business machine at slow speeds for later transmission at 800 words per minute.

A new control and signaling system being developed is intended to provide a complete communication and control system for supervisory control and centralized monitoring of multiple stations. Special cabinets, leased to the user, will send and receive all necessary code signals over the leased circuits interconnecting the points in the remote-control system. Push-button operation will eliminate many objections to the present dial-control system.

Private Communication Systems

In the early days of pipelining, telephone-company circuits were not available at many pump stations and field offices. Despite the tremendous

PIPELINE COMMUNICATIONS



growth and expansion of the telephone companies, there still are many pipeline locations where connections to commercial circuits are not feasible or adequate. Pipelines started building their own pole lines years ago, and today continue to build most of their own communication facilities.

Today's pipelines own and operate more than 400,000 channel-miles of communication circuits, not counting their mobile radio systems. Wire-line and telephone-carrier systems provide about 250,000 channel-miles of these circuits. The remainder, about 150,000 channel-miles, are pipeline microwave circuits. Leased circuits are used for an additional 150,000 channel-miles of pipeline-communication circuits.

Thus, about 70% of the total communications used by pipelines is furnished by their own private systems, still not counting the mobile radio systems. Four general types of circuits are used: telephone, teletype, remote control and telemetering, and VHF radio system relay circuits. About 20% of the total channel-miles is used for remote control and telemetering, which is an indication of the trend toward pipeline automation.

A more impressive illustration of pipeline communication facilities is made by the following summary of approximate figures:

Miles of wire lines—60,000.

Investment in wire lines and carrier systems—$60,000,000.

Miles of microwave—18,000.

Investment in microwave—$20,000,000.

Annual payments for leased circuits—$5,000,000.

The first pipeline microwave installation was placed in service in 1949, less than 10 years ago. Now there are 45 different pipeline companies using their own private microwave systems. In a 1956 communication survey made of the petroleum industry, each company was asked to give a 10-year forecast of its use of microwave.

From the replies received, it appears that by 1966 there may be about 70 pipeline users and a total of over 60,000 miles of pipeline microwave systems. The forecast includes additional types of microwave channel usage:

Closed-circuit TV channels.
Facsimile telephoto channels.
Telephone channels.
Teletype channels.
Telemetering channels.
Supervisory-control channels.
Alarm signaling channels.
VHF radio control channels.
Data-processing channels.

Wire Line vs. Microwave

Once a communication system is placed in service, pipelines begin to find needs for additional channels. Wire-line systems can be expanded by applying carrier channels. Carrier terminals are installed at the locations between which new channels are desired, and connected to the original pair of wires. Electrical filters are used to separate the various channels at the terminals.

The long-haul channels used by pipelines limit the practical number of carrier channels on a pair of wires to between three and five. Carrier systems are available, however, which provide up to 16 channels on one pair of open wires on a pole line. The technical problems and expense involved with this many channels are not justifiable for the normal pipeline system.

Most open-wire circuits are attached to pole lines bearing other wires owned by other companies. Complex wire transposition schemes are necessary to reduce interference between the various channels on the wires of all users sharing the poles. Carrier-channel amplifier units must be located at intervals along the wire route to restore the loss in carrier-channel signal volume: 200-mile intervals between amplifiers, for a 3-channel carrier system, become 50-mile intervals or less for a 16-channel carrier system.

Most pipeline communication engineers try to sell their managements on microwave when requirements exceed five to eight channels. Usually, a system with this many channels also has one or two teletype channels squeezed in somewhere. Adding carrier channels requires retransposing the wire lines and replacing carrier equipment. The new carrier equipment is more complex and more expensive. The cost of further expansion is enough to warrant a study of replacing the wire-line system with microwave. This is especially true if future additional growth is anticipated. Microwave provides 30 to 120 channels, depending on the type of equipment selected.

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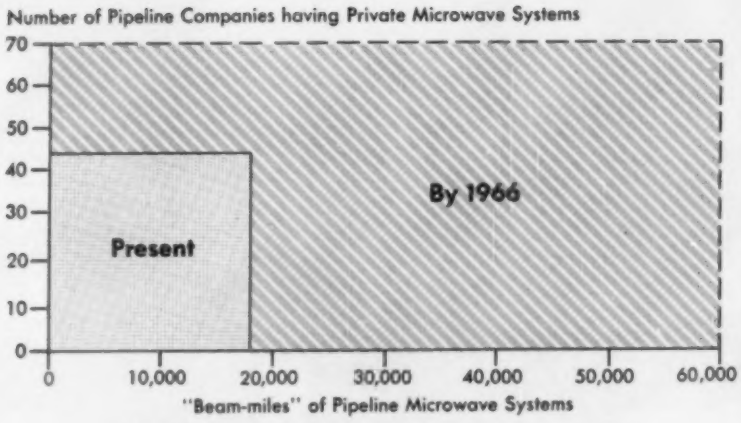


MICROWAVE USAGE—PRESENT and FUTURE

The wire-line-system expansion problem is not the fault of the carrier equipment. The electrical properties of the wire lines themselves produce the problems. Microwave simply provides a medium of carrying the channels which is not limited as wire lines are.

There is practically no loss in channel signal volume caused by the microwave-radio part of the system. The equipment used for microwave-communication channels is essentially the same type as used for wire-line-system-carrier channels. Most telephone-carrier equipment manufacturers now make both types, each type designed especially for wire-line channels or microwave channels.

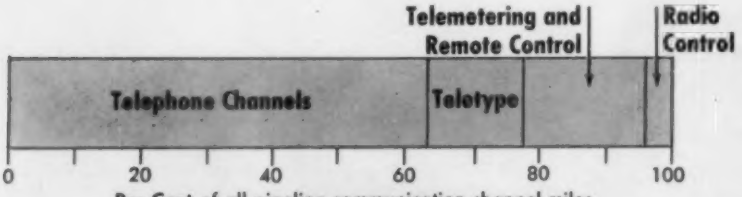
Status of Microwave

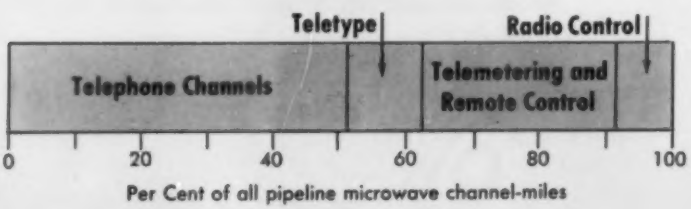
The acceptance of microwave by pipelines is attested by the number of pipeline users, the large investment in facilities, and the forecast of greater usage. This is emphasized by the fact that its licensing by the Federal Communications Commission still is on a developmental basis. Each transmitter is licensed with the express understanding that the license may be canceled without prejudice.

If the developments in microwave should prove unsatisfactory to the "public interest, convenience, and necessity," all microwave licenses could be withdrawn by FCC. This is highly unlikely in view of the high degree of successful microwave performance.

The oil and gas pipelines have been energetic in the efforts of industry to help FCC formulate rules and regulations for microwave. These rules will establish full-licensing status to microwave for private users. Since 1952, the American Gas Association and the American Petroleum Institute have had full committees and subcommittees at work on suggested rules.

These committees have cooperated with other industry groups, including the Electronic Industries Association (formerly Radio-Electronics-Television Manufacturers Association) in preparing compatible operating and technical standards.





The developmental status of microwave licensing, and the monopolistic interests of certain common-carrier telephone companies, are hampering the present growth of private microwave usage. Since pipelines own the greater majority of all existing private microwave, the daily value of this communication facility may be considered worth a lot more than the risk of losing it in the future.

Great pressures are being placed upon FCC to give priority for microwave-radio bands to the telephone companies. This would prevent private users from building their own microwave systems wherever the telephone companies could provide leased facilities. The hearings and arguments on this question have been going on since November 1956.

At that time, FCC proposed to reallocate all microwave-radio bands for all future users (FCC Docket 11,866). The proceedings on this project still are before FCC. The problems are extremely complex, involving both national and international frequency band usage, plus military and government assignments. In general, there is confidence that pipeline microwave will be given ample consideration. It is almost inconceivable that the tremendous pipeline contribution toward microwave development could be disregarded by FCC.

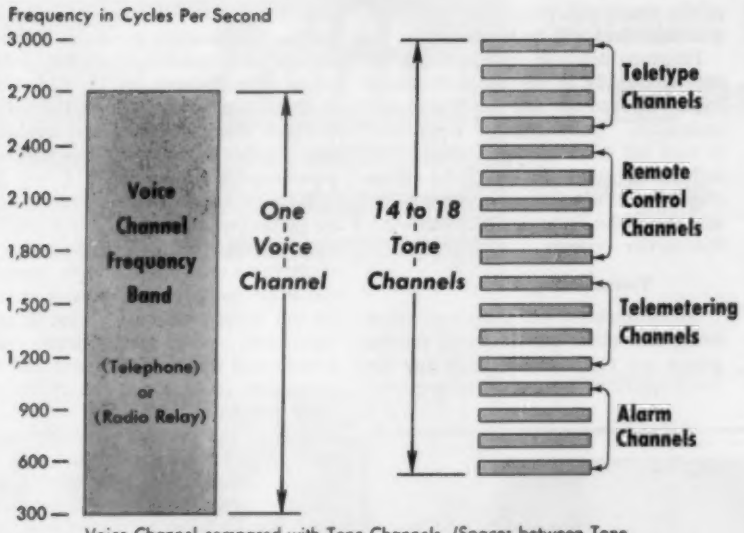
Microwave Equipment

There now are about a dozen manufacturers who supply microwave equipment for pipeline use. Each builds his equipment to operate in one or two of the present three principal pipeline microwave-radio frequency bands (960 mc.; 2,000 mc.; 6,700 mc.). Each, in general, claims particular advantages for use of the band for which his equipment is designed.

Fundamentally, the three bands provide radio paths which behave equally well. Differences lie in the radio band width used and the type of equipment best suited to each of the three bands. The techniques employed in design limit the 960-mc. equipment to short systems, or about 300 miles. Many pipeline microwave "spurs" or side hops from main-line systems use 960-mc. equipment.

About 12 voice channels are maximum for a 960-mc. system. In general, this type system requires two antennas for each direction of the system from a repeater station. Manufacturers are not devoting much effort to further development of 960-mc. equipment for pipeline systems, except for semiportable and mobile-radio purposes.

The bulk of pipeline microwave-sys-



Voice Channel compared with Tone Channels (Spaces between Tone Channels provide "Guard-Bands" to prevent interference between signals)

tem miles is provided in the 2,000 and 6,700-mc. microwave bands. The advantages of using either band are found in the type of equipment, primarily. But these advantages become secondary to many other factors which determine the type the user buys. Sometimes the deciding factor is the final price of a system which includes the telephone and control channels.

The actual total pipeline-system miles of microwave is about half 2,000-mc. radio equipment and half 6,700-mc. equipment. Good results are being experienced with both types of equipment used in present systems. Engineers who select a particular type of equipment for their system are influenced by background experience, contacts with other users, amount of time taken to investigate each type, and cooperation of prospective suppliers.

Each manufacturer supplies what he has decided is the best type of equipment, based on recommendations of many fine engineers. The performance of today's pipeline microwave systems is proof that both suppliers and users are on the right track, regardless of whose system is questioned.

With experience and time behind them, pipeline communication engineers are asking for improvements. The manufacturers are making changes in equipment design to raise performance standards.

Some of the equipment improvements being supplied or announced by manufacturers of microwave are:

- Use of transistors and printed-circuit boards in auxiliary circuits.
- Miniaturization of unit assemblies.
- Plug-in units and channels.
- Transistorized channel terminal units.
- Tubeless rectifier power supplies.
- Standardized system makeup.
- Improved fault-alarm systems.
- Improved system stability.

There are no startling or revolutionary improvements among the items listed above. Perhaps the more significant picture at this time is this: Manufacturers are attempting to make improvements which will increase reliability, improve performance, and simplify maintenance, while holding the line on production costs and sales prices.

Pipeline Microwave Channels

The techniques of providing many channels of communication in a microwave system can be listed under two general headings: time-division methods and frequency-division methods. Pipeline systems use various channelizing schemes under both headings.

The division of the channels into an orderly arrangement which can be combined at one station, applied to the radio signal for the trip through space to the next station, and properly separated for use, is called "multiplexing." Communication engineers speak of "single side-band," "double side-band," FM, and "time-division" multiplex techniques.

They all are methods of providing the carrier channels for the microwave system. They all are good. Opinions will vary as to which should be used for a particular system and its requirements. There are more frequency-division systems in service, and more being bought today, than time-division systems for pipeline use. The two longest pipeline systems, however, use the time-division type.

Whatever type of equipment is used to obtain them, channels are established in pipeline microwave systems to serve many operational functions. The following is a typical list of channel functions:

Service channel (or order wire) for microwave system maintenance.
Dispatcher's channel, private line.
Dispatching party-line channel.
General business private-line channel.
Pump-station party-line channel.
Operational private-line channel.
Operational party-line channel.
Supervisory-control channel.
VHF radio-control channel.
Special-function channels.

The term "operational" covers many business functions. Some of these are:

Oil or gas movement schedules and control, besides dispatching.
Construction coordination.
Engineering coordination.
Material and equipment control.
Line and station maintenance.
Instructions to operating personnel.

A few channels allocated to specific functions have demonstrated to pipelines that operating efficiency is gained by giving those functions a clear channel. It follows that other functions are given special channels. In this way, pipelines have found sound usage for many more channels than was thought practical in the past. Available equipment can provide up to 120 voice channels. One pipeline system is actually using about 70 channels.

Telephone Channels

About two-thirds of all pipeline communication channels are used for talking purposes. This includes microwave, wire-line, and leased-circuit channels. About half of the pipeline microwave channels are for telephone use. Microwave is a newer thing and is being used more for some of the other communication functions.

These telephone circuits, particularly over microwave, make it economically possible to set up phone channels between specific pipeline locations where they can serve the best purposes. The urgency of some operations is great enough to provide alternate channels for the same function. Trouble at a gas-pipeline compressor station might require attention before another conversation was finished or broken off to permit use of the channel for emergency purposes.

A few pipelines have included dial systems for their telephone channels. This provides even greater efficiency

in the handling of calls between locations where personnel normally are near their phone.

Teletype Channels

Recorded messages for gas, oil, and petroleum-products pipeline operations are handled best with teletype. TWX and leased teletype services provide about half of the channel-miles used by pipelines for message traffic.

More private-teletype usage is forecast by pipelines because microwave makes it easier to get a channel into the desired locations. The growth of business automation will create needs for more teletype channels between points where data-processing and business machines will be located.

Fourteen teletype channels can be provided easily in the communication space required for one voice channel. Individual "subchannel" equipment is used for each teletype circuit. The techniques used for deriving these channels in a microwave system are essentially the same as used with wireline-carrier systems.

Telemetering Channels

Measurements of pressures, flow rates, and other conditions at remote points are made available at any desired locations by use of telemetering subchannels on the communication system. These often are called telemetering "tone channels." About 14 different tone channels can be used within the voice space of one telephone channel. Each of these tone channels can carry a different telemetered measurement continuously.

Pipelines have many measurements at each compressor or pump station which could be telemetered. They apply these channels sparingly because the importance of the measurements do not justify the cost of the instrumentation. Key measurements are telemetered which provide essential information about conditions at the remote points.

One of the present uses, becoming more popular, is the telemetering of simple alarms. This was one of the earlier applications when pipelines first started telemetering over simple telegraph circuits. Sometimes the greater cost of supervisory-control equipment can be saved at those locations where an alarm or two will suffice. These are telemetered to the nearest attended operating point for attention and necessary action.

Telemetering channels are used in conjunction with remote-control systems to supply supplementary data from each remotely controlled station. Today's techniques include "digital" telemetering, but the telemetering channel handles this as well as any other type. Instrumentation provides the measurements in digital form; the tone channel simply carries the electrical impulses.

Remote Control and Centralized Monitoring Channels

About 20% of the total channel-miles of all pipeline communications is used for remote-control and telemetering purposes. About 30% of all pipeline microwave channel-miles is used for these functions. Automation in various stages of progress and development is responsible for this type of functional usage.

Centralized monitoring consists of a combination of remote indications and telemetered values from several remote locations. The status of valves (open or closed) and pump units (on or off) at each location is indicated at the central monitoring point of the system.

Various failures at each location are indicated by a lamp or annunciator at the monitoring point. These indications normally are provided in the remote-control-system equipment, and show "what" has happened at the various remote locations. The telemetering of "how much" requires instruments to measure and instruments to indicate or record the values.

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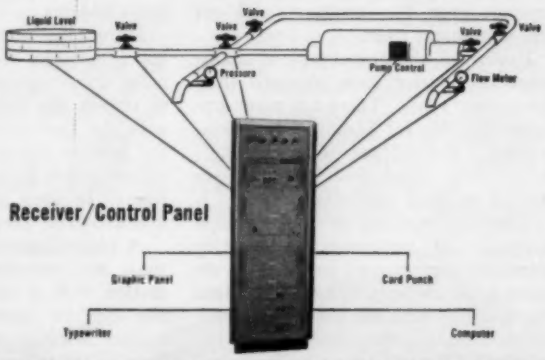

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The communication system provides channels for these purposes in the same manner described for telemetering channels. Fourteen channels are available for this purpose in each voice channel. The actual number of tone channels required, however, is dependent upon the remote-control-system equipment itself.

In general, the digital type of equipment uses fewer tone channels than most other types. There are many options available for handling the telemetering. The option selected determines how many tone channels are needed in each particular case.

The tone channels set up for remote control and centralized monitoring normally are grouped together in the same voice channel. When this is done there is no room left for actual voice-telephone use in the same channel. For a simple system involving only one remotely controlled station, however, it is possible to talk over the same voice channel used for telemetering and control.

The communication system, whether wire line, carrier, or microwave, carries teletype, telemetering, control, and indication signals equally well. The techniques of providing the tone channels for these types of signals are the same for each type. Tone-channel equipment is relatively inexpensive, reliable, and simple.

VHF Radio Control Channels

VHF (very-high-frequency) is an arbitrary designation for the radio bands used by pipelines for mobile radio systems.

Many pipeline mobile radio systems are integrated with portions of the main communication lines. In order to obtain the desired radio coverage area, the base station is located where the ground elevation can save on required tower height for the radio antenna. In some cases this will be on a microwave tower.

A voice channel is provided on the main line, connecting the radio base station with a remote-control box at the desired operating point. Radio traffic with radio-equipped vehicles then is relayed over the voice channel in both directions. Such an arrangement makes it possible to relay radio traffic any distance to any point on the communication system.

Microwave-System Auxiliaries

One of the outstanding advantages of a microwave-radio relay communication system is the absence of need for a continuous, across-country right-of-way. The continuous exposure of open-wire pole lines subjects wire-line systems to a multitude of hazards. On the other hand, microwave has some offsetting physical requirements.

Each relay station needs a plot of high ground, a source of electric power, a building, and a tower. Usually some fencing is desirable around the building and tower. An all-weather access road from the nearest highway is essential. Often some earthwork is necessary to level an area for the building and tower base. Road culverts and fence gates about complete the list, except for cattle guards around the anchors for the tower guying cables.

Reliability of communications is the ultimate aim of the pipeline microwave system. Rural electricity from commercial power lines is not reliable enough in many areas yet. The number and duration of outages would be intolerable. Emergency electric-power plants are installed in the microwave stations served by these electric lines. Some companies prefer batteries, others have engine-generator units.

Some companies use batteries in certain microwave stations and engine generators in others. There is pronounced preference for butane and propane fuel by those using engine

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generators. Emergency power is brought into operation automatically when the commercial electricity fails. Engines using gasoline have been found less reliable on automatic starting than those using propane or butane.

For additional reliability, pipelines buy standby microwave-radio equipment for each station in the system. The standby equipment automatically goes into operation when the main microwave radio units fail. The duplicate equipment also permits the maintenance man to do his routine checks without interrupting communications. Main units can be checked after the standby units are manually switched to the operating condition.

Automatic alarm equipment is installed in most pipeline microwave stations. Troubles and outages in the system are reported to the station equipped as the alarm control point. This expedites the location of any trouble and results in less outage time. One of the alarms always is assigned to tower lights.

TYPICAL REPEATER COST—1958

Microwave ratio equipment, with automatic standby, fault alarm, switchover controls, (two sets, one for each direction, except alarm)	$14,000
Multiplex carrier equipment for six voice channels	7,500
Antenna system equipment	3,000
Equipment installation and alignment	2,000
Pipeline company supervision and expenses	500
Subtotal, installed equipment	$27,000
Tower site, 3 acres, Midwest pasture	$2,400
Site preparation, access road	1,000
Fencing around building and tower	800
240-ft. tower, material	4,800
Tower erection, painting	3,600
Tower lights and beacon flasher with alarm	1,000
Concrete block building, electric wiring	6,000
Engine-generator unit and fuel tank	2,400
Pipeline-company supervision and expenses	2,000
Subtotal, auxiliaries	$24,000
Total cost, typical pipeline microwave repeater	$51,000

Microwave System Costs

Auxiliaries for a pipeline microwave system account for a large part of the total cost. This can be illustrated best by a tabulation of approximate costs for a typical pipeline microwave repeater station.

Nominal spacing between microwave repeater stations is about 25 miles. If each repeater costs about the amount illustrated above, the unit-cost of a typical system would by approximately $2,000 per system-mile. Many factors will affect the actual cost of a system. Land has no definite price. Tower heights will be different. Labor costs and site preparation will vary for different locations.

The "per mile" cost estimate for a pipeline microwave system is misleading unless derived from a more accurate estimate of actual requirements for each station. The earlier claims of $1,000 per mile microwave systems no longer apply to new pipeline "backbone" microwave systems today.

A few systems now in operation are jointly owned by two or more pipeline companies. The investment and operating costs are shared, with a nonprofit arrangement, while the chan-

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- **Frequency Diversity** . . . provides maximum circuit continuity in 5925-6425 MC band.
- **Plus outstanding Motorola developments for 6000 MC operation** . . . explained in detail in Brochure 1188.

MOTOROLA MICROWAVE

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nels used by each company are just as private as if the system belonged to each user alone. FCC favors joint usage because it conserves the number of frequency bands. The microwave and its carrier equipment provide enough channels to serve the full needs of all joint users.

Status of VHF Radio

Pipeline companies own and operate thousands of two-way radio stations, both fixed and mobile. Certain areas of operation have become congested to the point of near-intolerable interference among users on the same radio channel. There are not enough channels for each user to have his own, and geographical separation has become saturated.

A plan for "channel splitting," favored by pipelines, recently was announced by FCC to help relieve the congestion in the 25-50-mc. radio range. The plan would almost double the number of radio channels used by pipelines in this range, but with "narrow-band" separation between channels.

Some companies already have narrow-band radio equipment, or units which can be converted for a nominal cost of $20 to $100 per station. Other companies will have to trade off their old units for new. Equipment authorized by FCC for new radio systems after November 1, 1958, will have to comply with the narrow-band standards. All equipment will have to comply by October 1, 1963.

Another recent FCC move reallocated two blocks of radio channels used by pipelines to other uses. The channels between 46.51 mc.-47.0 mc. and between 49.51 mc.-50.0 mc. were reassigned to government and nongovernment "ionospheric forward scatter" radio use. Pipelines and other users affected were given new narrow-band radio channels in the 150-mc. region. The shift of bands becomes effective after October 1, 1959. Those pipelines making the move will have to trade their present equipment for new units.

Technical Developments

The years 1957 and 1958 have seen the transistorized power supply for mobile-radio units become a production-line option. One radio manufacturer has announced the early availability of completely transistorized mobile-radio units. This means more rugged equipment which will not use vacuum tubes. It will take less power from vehicle batteries. The units will be smaller and lighter in weight. Greater reliability is predicted.

In microwave, manufacturers' engineers have turned from pure radio techniques to more standard telephone practices in their treatment of the carrier-channel equipment. This is making the interconnections between microwave channels and wire-line telephone channels more compatible without special coupling devices.

Reliability of microwave paths over areas of severe fading now can be made good by using "diversity" techniques. "Frequency diversity" provides two microwave-radio paths continuously to eliminate fading caused by the loss of one radio path. Such feeding is caused by high humidity and calm weather where the radio path is over flat terrain. Only one radio channel at a time fades out, which leaves the other channel path in service. Diversity equipment is about 50% more costly than standard microwave standby equipment.

Many technical problems remain in all phases of pipeline communications. The communication engineer working for the pipeline is constantly seeking better equipment and better ways of using what is available. His is primarily a job of application engineering. It includes judicious selection of economical and reliable equipment.

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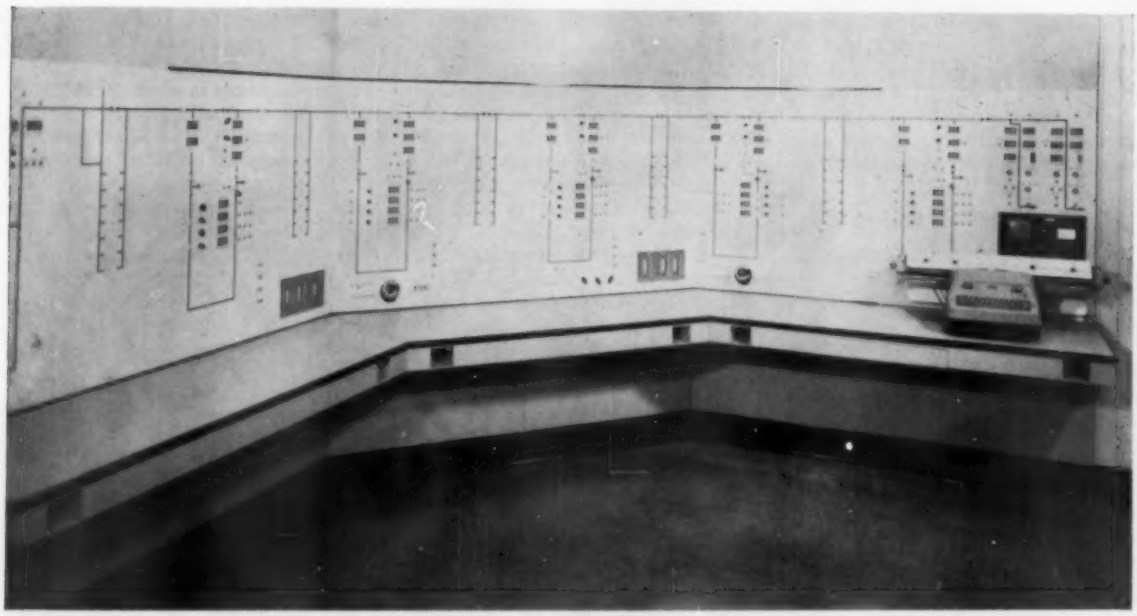


CONTROL BOARD is focal point of Gulf Interstate automation system. There are 12 panels—one for the gathering system, one for each semiautomatic station, one for each automatic station, and one for the delivery points at Leach and Means.

First push-button gas pipeline

is now in successful operation

Special Report

BY SY ORLOFSKY
Vice president,
Gulf Interstate Gas Co.

AFTER more than 5 years of planning and development, Gulf Interstate Gas Co.'s system of pipeline automation is now in service.

Conceived by Gulf Interstate engineers even before the company commenced operations in November 1954, the "push-button pipeline" actually evolved from theory to design to practical application in the form of an experimental satellite station at Stanton, Ky., in less than 2 years.

The Stanton station was the prototype for five fully automatic centrifugal-compressor stations spaced some 180 miles apart along the main line and alternated with five semiautomatic stations. The automatic stations were built and placed in service during 1957 and operated attended until the automatic equipment was installed. The semiautomatic reciprocating plants have been in service since 1954.

The first of the 14,000-hp. automatic stations, the Hartsville, Tenn., plant, was placed on completely unattended remote operation on May 22, 1958. Three others at Stanton, Ky.; Corinth, Miss.; and Alexandria, La., followed in a matter of days. When an automatic controller at the fifth, Inverness, Miss., is placed in service, a total of 70,000 hp. will be operated directly and entirely from the company's Nashville office.

Machinery Selection and Reasons

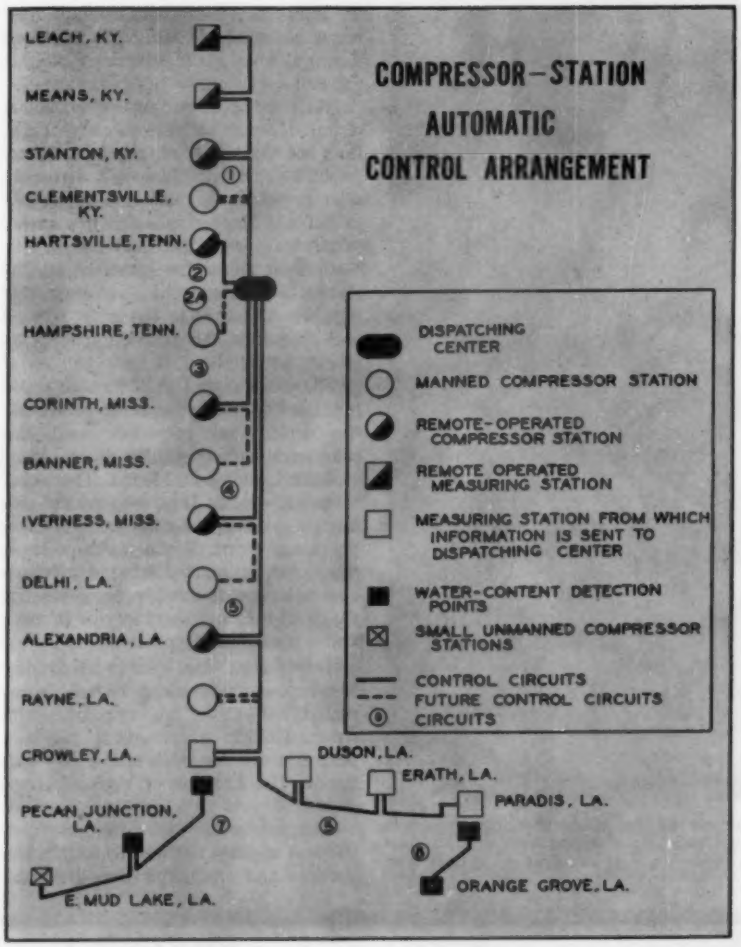
The stations that are operated unattended and automatically from the Nashville gas control center consist of four 3,500-hp. Cooper-Bessemer LSV-16 super-charged gas engines driving Cooper-Bessemer centrifugal compressors through speed increasers.

The speed increaser which is the intermediate component of the engine-compressor mechanical system is maufactured by Western Gear Works, of Lynwood, Calif., and is designed to transmit a maximum of 4,560 hp. at a maximum output speed of 6,055 r.p.m. The gear is a two-stage double-helical, separate helix articulated-type unit and has a ratio of 16.82 to 1.

The LSV engine and compressor sets were primarily selected for automatic operation because of their ability to perform at high efficiency through a wide speed range. The variable-speed and variable-torque engines run from 270 to 360 r.p.m.

The table and chart on pages 116 and 117 primarily depict a comparison of fuel consumption for the month of December 1957 for Gulf Interstate Gas Co. semiautomatic and automatic compressor stations. The centrifugal stations show an improved fuel economy of 11.5% over their reciprocating counterparts. The reciprocating stations averaged 7.8 cu. ft. per developed horsepower hour as compared to 6.7 cu. ft. per developed horsepower hour for the centrifugal plants.

Another reason for the choice is that the engine-driven centrifugal's physical arrangement readily adapts



FROM NASHVILLE CONTROL center one man can operate five automatic compressor stations of 14,000 hp. each and control the flow of gas leaving the system at two transport delivery points in Kentucky.

itself for locating all the high-pressure piping and compressors outside of the engine room. A 12-in.-thick concrete fire wall separates the engines and their auxiliary and control equipment from the compressors and high-pressure gas piping. The reinforced concrete fire wall is designed to withstand a force of 65 lb. per sq. ft.

In addition to the advantages of high engine thermal efficiency and ease of equipment arrangement, the centrifugal compressor is a low-maintenance and trouble-free machine.

Central Control Board

The nerve center of Gulf Interstate's push-button pipeline is a centralized transmission control console on the twenty-second floor of Nashville's Life & Casualty Tower.

All of the information between the Nashville board, measuring stations, and mainline compressor stations is transmitted digitally. Digital telemetering allows the handling of data and orders without errors in transmission.

The receiving equipment will not accept any coded binary decimal which is not correct. The equipment has the intelligence to discern what data should be brought to the dispatcher's attention, which eliminates the need for continuous telemetering. Data are brought in and digitally displayed on change of conditions.

The Nashville board, for the first time in the history of the natural-gas industry, enables one man to control and supervise the flow of gas through an entire transmission pipeline, a pipeline which consists of 140,550 hp., 350 miles of gathering system, and 841 miles of 30-in mainline. The present design capacity of the system is 575,000 M.c.f. daily at 14.73 psi. The main line has a working pressure of 935 psig.

One-man control . . . From the board in Nashville a single dispatcher will be able to:

1. Monitor operating conditions, including rate of flow and pressures at two major intake points and two check measuring stations, along with water content at four junctions of the 350-mile gathering system in South Louisiana.

2. Monitor operating conditions and control the discharge pressures at the five semiautomatic reciprocating compressor stations which also total 70,000 hp., and tell whether or not a 550-hp. field booster station is in operation. A semiautomatic reciprocating station consists of seven 2,000-hp., two-cycle gas engines driving reciprocating compressors.

3. Actually operate the five automatic centrifugal compressor stations, start or stop any or all of the four 3,500-hp. engines at each of these stations, shut down any station when necessary, control discharge pressures, and monitor operating conditions of all 20 engines and all 5 stations.

4. Control the flow of gas leaving the line at the two delivery points, Leach and Means, Ky., and monitor flow and pressure conditions.

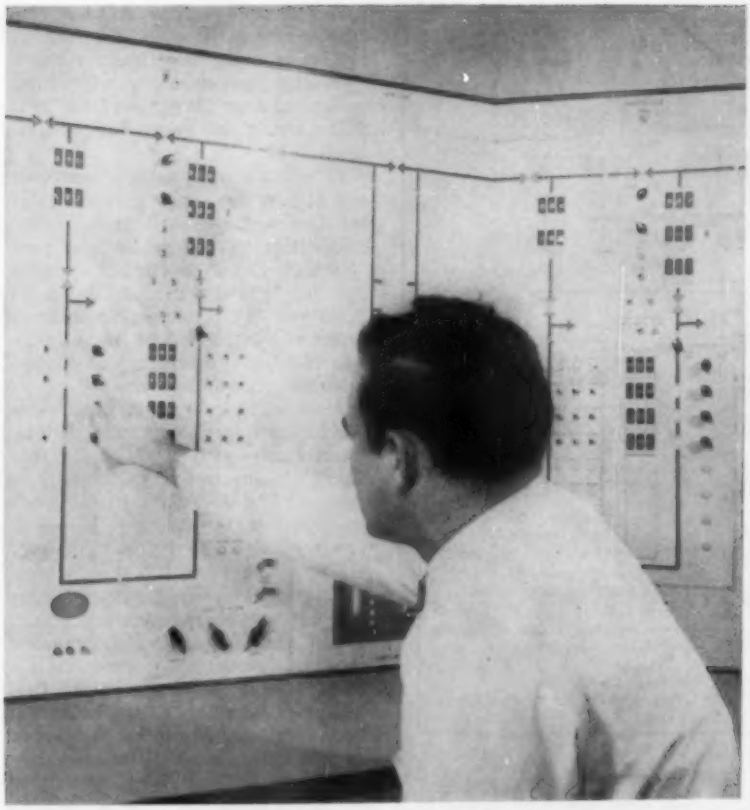
As of right now, not all the field equipment auxiliary to the board has been completed, but it will be installed as it becomes ready. The work that remains to be done should be finished by midsummer.

The board arrived from the manufacturer, Union Switch & Signal, Division of Westinghouse Air Brake Co., on March 24, 1958, and installation began immediately. The linking of the board with the equipment necessary to carry out its orders at the stations proceeded rapidly.

On April 2, 1958, all four engines at Corinth and two engines at Hartsville were started up by remote control from Nashville. The others followed as they became ready.

What control panels show . . . The board itself is 18 ft. long in three 6-ft. sections set at 45° angles to each other. Although the board extends from floor to ceiling, the control panels themselves are only 40 in. high. There are 12 of these panels. From left to right in their proper sequence on the pipeline there is one for the gathering system, one for each semiautomatic station, one for each automatic station, and one for the delivery points at Leach and Means.

When completed the first panel will show the dispatcher the flow, static pressure, and the number of metering tubes in operation at two major gas-supply points, Paradis and Erath, La. Flow and static pressure at Duson and Crowley, La., check measuring locations on the east and west laterals, are also indicated on this panel. There



ENGINE 503 is off the line. To start the unit all the dispatcher has to do is turn the button to the left and push. The signal goes to the station and puts other circuits to work in an engine-startup sequence that requires no supervision from anyone in the station.

are lights to indicate the range of the water content of the gas passing through four main junctions of the gathering system.

At the opposite end of the board the dispatcher will be able to control the flow of gas out of the system at Leach and Means. There is a set-point selector which enables the dispatcher to set the desired gas-delivery rates. When he pushes the send button the equipment at the transport measuring station will automatically adjust the number of metering tubes in service and reposition the flow controllers to meet that delivery.

There are digital indicators to show him the flow rates, the static pressures, the differential pressures, and the number of metering tubes in operation at both Leach and Means. The same set-point selector is used to set the discharge pressure at each of the compressor stations. When a set point is sent to a station a discharge pressure controller automatically regulates the r.p.m. of the engines in service to meet and maintain that pressure.

The panels for the reciprocating semiautomatic stations when completed will show the dispatcher the r.p.m. of each engine and station suction and discharge pressures and will enable the control of the discharge pressure.

The panels for the automatic centrifugal stations tell the dispatcher the suction and discharge pressures, the

Compressor-Engine Fuel Study

COMPRESSOR-ENGINE FUEL STUDY—DECEMBER, 1957

Engine compressor location	Installed horsepower: Rated total	Hours available	Hours utilized	Utilization per cent	Compression: M.c.f. compressed	Suct. press. psig.	Disch. press. psig.	Ratio
Cooper-Bessemer GMWA8 (reciprocating):								
Rayne	14,000	10,416,000	9,296,000	89.2	17,438,523	625	935	1.484
Banner	14,000	10,416,000	10,018,000	96.2	17,852,352	605	932	1.527
Clementsville	14,000	10,416,000	9,244,000	88.7	17,555,394	632	935	1.468
Totals and avg.		31,248,000	28,558,000	91.4	52,846,269			
Clark TLA6 (reciprocating):								
Delhi	14,000	10,416,000	9,840,000	94.5	18,005,896	647	935	1.435
Hampshire	14,000	10,416,000	10,228,000	98.2	17,696,357	600	928	1.533
Totals and avg.		20,832,000	20,068,000	96.3	35,702,253			
Cooper-Bessemer LSV-16SG (centrifugal):								
Alexandria	14,000	10,416,000	9,159,500	87.9	17,986,287	648	935	1.433
Inverness	14,000	10,416,000	9,670,500	92.8	17,931,050	615	935	1.508
Corinth	14,000	10,416,000	10,125,500	97.2	17,781,200	608	933	1.522
Hartsville	14,000	10,416,000	10,073,000	96.7	17,628,234	619	931	1.492
Stanton	14,000	10,416,000	7,990,500	76.7	17,502,992	674	935	1.379
Totals and avg.		52,080,000	47,019,000	90.3	88,829,763			

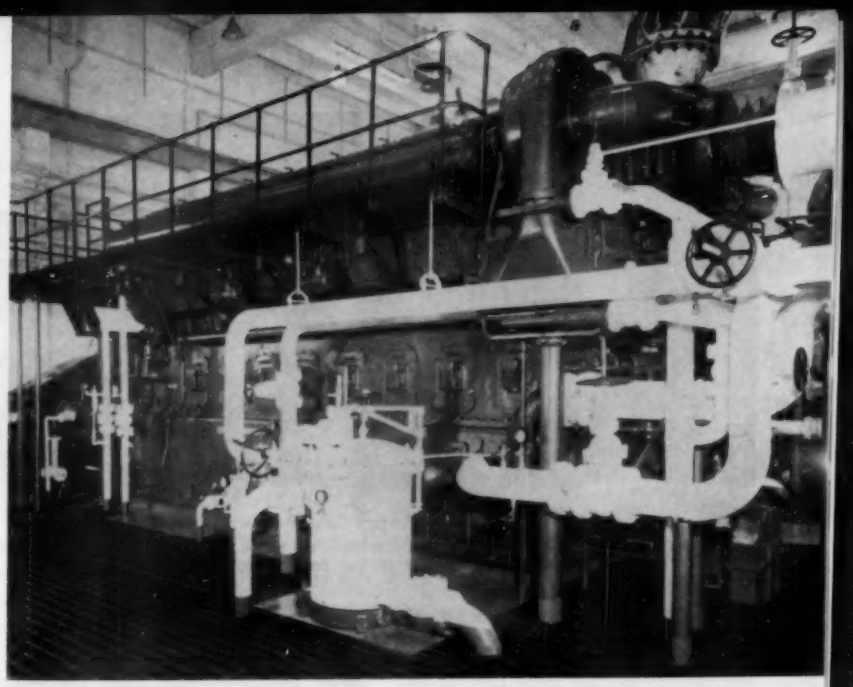
flow in MM.c.f.d. and the r.p.m. of each of the four engines at each station.

Arrow-shaped blue lights in appropriate places are lit when the important gas-control valves in the station yard are open. These are the side gate, fire gate, and block valves. The lights are off when these valves are closed.

Vertical blue lights are lit to show which engines are running. Orange lights beside the engine lights are lit when engines at any of the stations are being operated on local sequence. When the orange lights are out the dispatcher knows he has remote sequence control of the engines.

Safety and warning functions . . . There are also shutdown lockout, shutdown restart, and alarm lights for each engine. When the SDLO light comes on, the dispatcher knows instantly that a serious mechanical failure has shut down that engine and that the engine must be checked and the trouble corrected before it is restarted. The SDRS light tells him that a minor complication has shut down an engine.

The engine can be restarted and operated if the difficulty has cleared itself. When the alarm light for an engine comes on it tells him that there is a faulty condition to be checked, but that it is not serious enough to shut the engine down.



PRIME MOVER at automatic centrifugal stations is this Cooper-Bessemer 3,500-hp. LSV-16 supercharged gas engine. Each station contains four of these engines.

Another set of lights on each panel shows the pressure ranges for station engine starting air. A warning light and bell alert the dispatcher that a station alarm has been actuated.

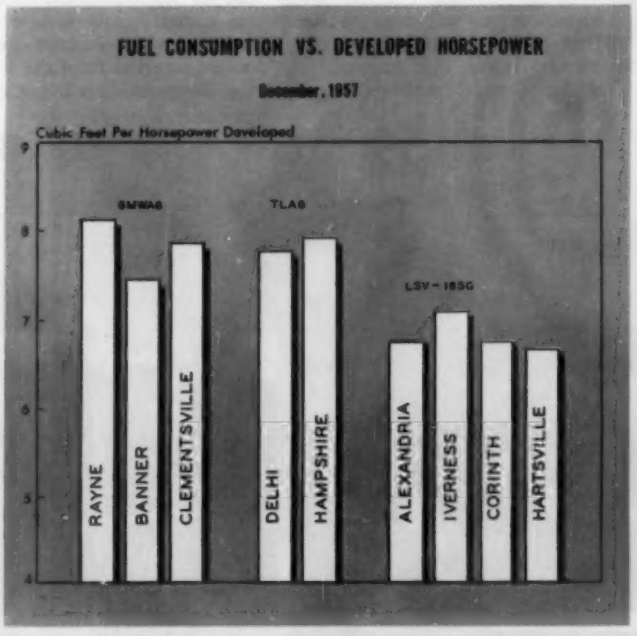
The a.c. off light comes on when there is an electrical power failure at a station. The Nashville a.c. off light comes on if there is an electrical power failure in the Nashville office. In case of a.c. failures, however, the board and stations will continue to function from storage batteries which automatically take over the electrical load of the controls.

A surge light indicates when compressor surge or no flow conditions are encountered at the station.

The station test light comes on to tell the dispatcher that plant personnel

December, 1957

Load on utilized engines		Fuel consumption	
Average per cent	Developed horsepower	Total cu. ft. @ 15.025 psi.	Cu. ft. per horsepower developed
89.4	8,307,965	67,563,000	8.132
102.5	10,272,072	76,235,000	7.422
97.5	9,016,094	70,407,000	7.809
96.6	27,596,131	214,205,000	7.762
92.2	9,069,445	69,606,000	7.675
102.5	10,493,593	82,660,000	7.877
97.5	19,563,038	152,266,000	7.783
101.5	9,297,836	62,380,000	6.709
107.1	10,358,903	73,554,000	7.101
102.4	10,371,978	69,739,000	6.724
98.8	9,953,563	66,300,000	6.661
94.7	7,567,019	50,541,000	6.679
101.1	47,549,299	322,514,000	6.783



FIRE WALL and lift slab concrete construction of main engine room are seen in this view of Corinth, Miss., compressor station. The structure at extreme left is the cooling tower for engine No. 4.

are doing work that requires the bypassing of certain electrical engine safety devices. During such occasions the engines are on local control and protected with basic pneumatic safety devices.

A circuit fault light on each panel tells the dispatcher when there is a malfunction in the telemetering circuit between Nashville and a station.

There is a station shutdown button for the dispatcher to actuate when an entire station has to be taken off the line in an emergency.

An open-close button enables the dispatcher to operate the block valve at each station.

The data recall button, when pushed, roll-calls and scans all digital indicators on the panel to recheck the displayed information.

The indication recall does the same with the light indicators representing the alarms, valves, and engines.

The lamp test is pushed to verify all lights on the panel are in working order.

The set-point deviation light informs the dispatcher when the discharge pressure at a compressor station varies from the requested order.

The code cancel button permits the dispatcher to stop a signal in progress.

Telemetering . . . Each of these panels is linked to its station by a d.c. telemetering circuit, furnished and maintained by AT&T or Southern Bell Telephone Co. depending on the location of the compressor station. Individual telemetering circuits serve the automatic stations.

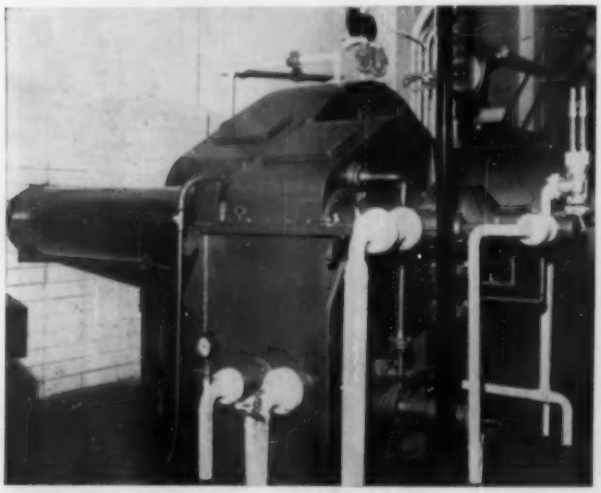
Coded signals, a different one for each control function of the board, are initiated at the board and travel over the d.c. circuit to the station. There the coded signals actuate relays and switches which in turn carry out the orders received from the board. After the dispatcher performs the manual function of pushing a button, every part of the sequence of carrying out the order occurs automatically.

Similarly, telemetering data from the station to the board is automatically activated by change or call. There are also automatic safeguards which warn the dispatcher if his orders are not carried out properly.

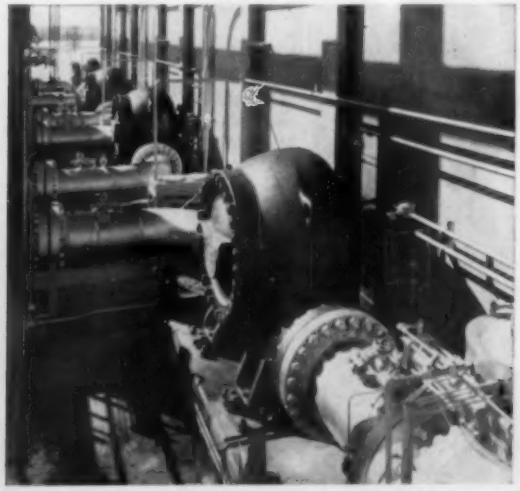
Placing Engine On Line

To place an engine on the line the dispatcher actuates the starting sequence signal by depressing the engine start switch. The dispatcher knows the signal has gone out by the appearance of a flashing white light. A steady white light shows when a code is sent from the station and is being received at the board.

At the station the received signal energizes a bank of relays which sets in motion the process of starting the engine. As soon as that is done a feedback signal initiated at the sta-



WESTERN GEAR speed increaser, a two-stage unit specifically designed for this application, transmits power from the main engine to the centrifugal compressor.



CENTRIFUGAL COMPRESSORS and all high-pressure piping are located outside the engine room, protected by a 12-in.-thick concrete fire wall.

tion returns to the board and is displayed as a flashing blue bar light. This light is the engine running-condition indicator. The feedback signal tells the dispatcher that the code has been received correctly and the starting sequence is being activated.

Meanwhile, back at the station the process started by the coded signal is still going on. Automatically as the intelligence is passed on from relays to switches to energizers and other devices, compressed starting air rolls the engine to cranking speed, the ignition comes on, the fuel gas is turned on, the engine begins to fire, the starting air goes off, the engine comes up to starting speed, the discharge valve opens, the centrifugal compressor goes into action and, finally, the suction valve opens and the compressor goes on stream under the direction of the discharge-pressure controller.

A similar process is followed when shutting down an engine.

An engine will not obey a start or stop order until all conditions for the action are correct. The dispatcher observes the results of the starting or stopping sequence by viewing the board.

The automatic control of a station is not dependent on the telemetering circuit. When a telemetering circuit failure is experienced, the station will continue to run fully protected and in complete control. It will operate following the last orders it received until the circuit is restored or the station is taken over locally.

Logging, Communication, Flow Computation

Auxiliary to the console is a 30-in. carriage IBM typewriter which will automatically record on a log sheet gas flows, suction and discharge pressures, and number of engines running at all 10 stations as well as operating information from the gathering system and delivery points. The typewriter can be set to record every hour, half hour, quarter hour, or on demand. This provides the dispatcher with a permanent record of the operating conditions on the pipeline. This information was formerly taken by telephone at 2-hour intervals.

The VHF company radio and the Conelrad radio are set into the delivery panel. There are two telephones and a distance talking set which allows the dispatcher to communicate with his party without using a telephone hand set.

Another feature of the control console is the all-relay digital computer. The computer calculates gas flow to an accuracy of 0.25%. The flow information from the computer is displayed digitally for each of the centrifugal stations and for the intake, check, and transport measuring stations.

The central control board provides the dispatcher with the means to operate the pipeline at maximum efficiency for he has a complete record of the conditions on the pipeline at all times. The dispatcher has available a flow of information which enables him to alter line conditions immediately as delivery orders may require. The operational success of Gulf Interstate's automation has encouraged Gulf Interstate Gas Co. engineers to continue their persistent and creative search to develop additional methods of transporting natural gas to market areas safely, dependably, and economically.

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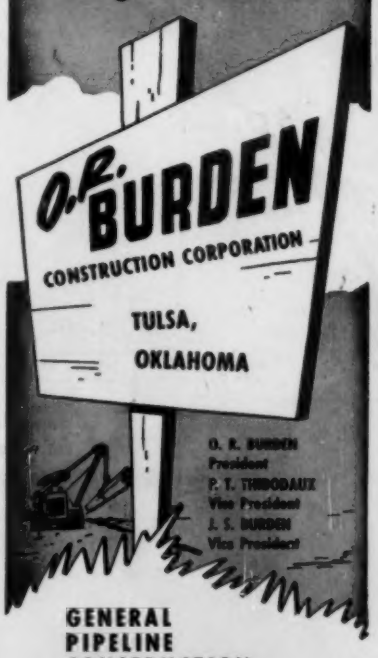

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5

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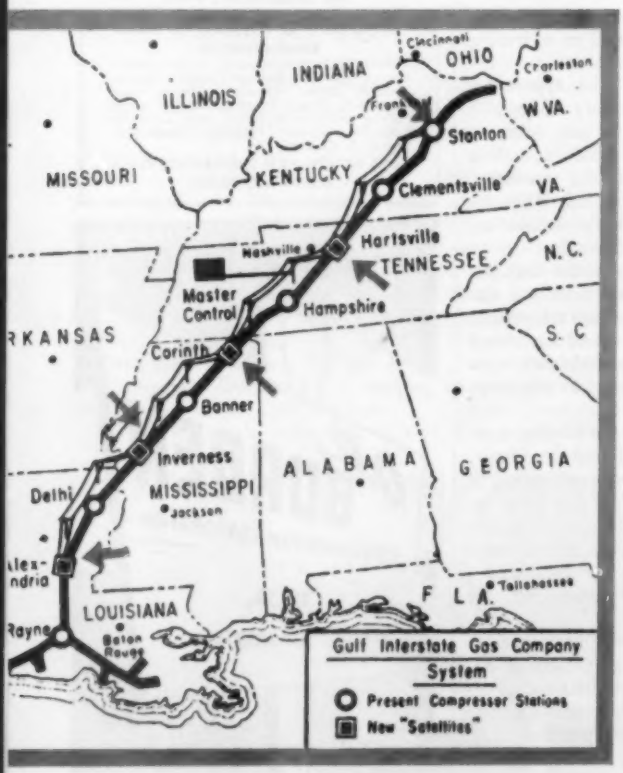

70,000 horsepower of remote controlled LSV-16 turbo-charged gas engines, driving Cooper-Bessemer RFB-24 centrifugal boosters on Gulf Interstate's pipeline. These are the world's most efficient compressor units and are operating in five separate unattended stations.

Based on the successful operating record and outstanding fuel economy of the initial one unit installation at Stanton, Ky., Gulf Interstate increased this station to four engine-driven centrifugals and powered new stations at Hartsville, Tenn., Inverness, Miss., Corinth, Miss., and Alexandria, La., with four high-efficiency Cooper-Bessemer units each.

For detailed information on advantages and applications of automatic pipeline control, write The Cooper-Bessemer Corporation, Mount Vernon, Ohio.

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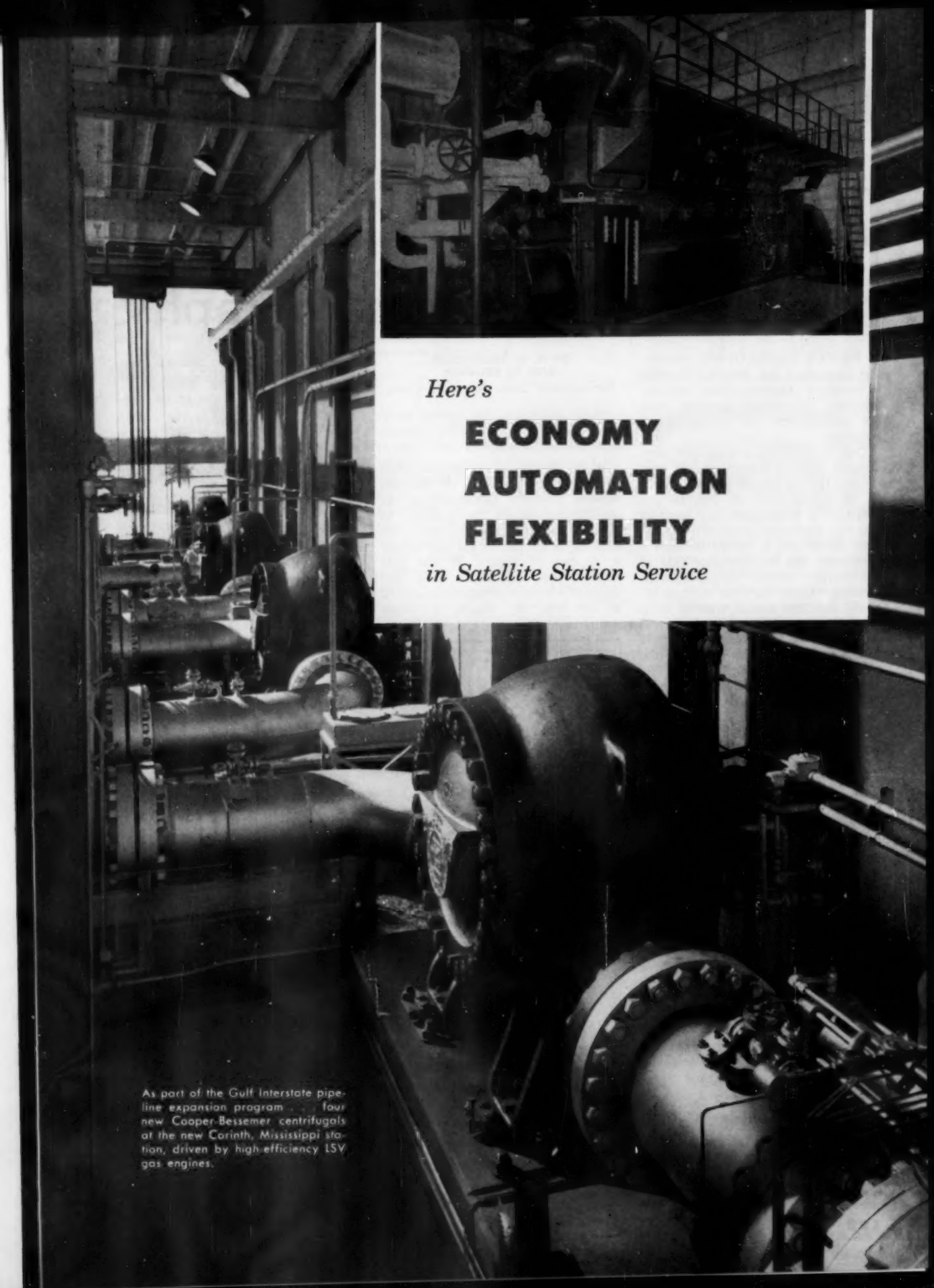


Here's

ECONOMY
AUTOMATION
FLEXIBILITY

in Satellite Station Service

As part of the Gulf Interstate pipeline expansion program . . . four new Cooper-Bessemer centrifugals at the new Corinth, Mississippi station, driven by high efficiency LSV gas engines.

Instrumentation techniques play a vital role in chemical analysis by

Gas chromatography

BY H. M. HAUSDORFF
AND N. BRENNER
Perkin-Elmer Corp. Norwalk, Conn.

A NEWLY DEVELOPED commercial instrument for chemical analysis is based on elution-partition chromatography. It's design, however, does not prohibit the use of adsorption columns.

Fig. 1 represents a schematic flow diagram of the instrument. A continuous flow of carrier gas is supplied to the system from an external gas bottle. It is maintained at a constant rate by a dual-stage pressure regulator. The carrier gas is passed through a flowmeter and the reference side of the detector to the sample-injection locations. Gases may be metered directly into the stream without heating. Liquids are injected into a heated chamber which serves to rapidly vaporize the sample, whereupon the carrier-gas stream will move the vaporized material onto the column.

The components of a mixture will be carried through the column at different speeds. They ultimately arrive separately at the exit of the column which is directly connected to the sensing side of the detector. The vapors and carrier gas then pass out to the atmosphere or a suitable collecting system. The two detector sides are part of a bridge circuit of which the unbalance is constantly measured by a standard recorder.

Sensing Device

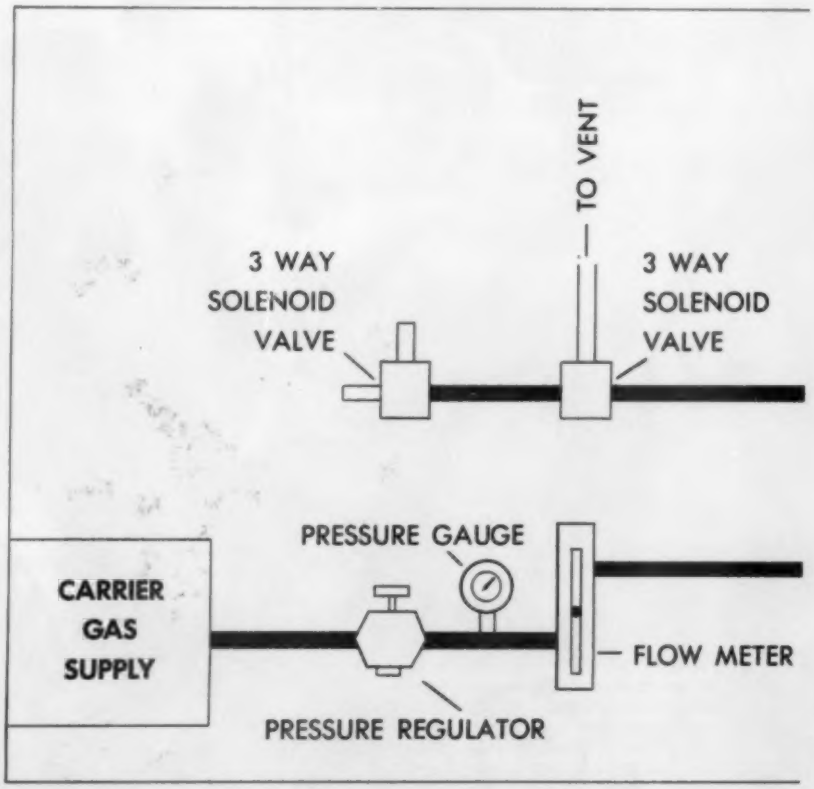
In the design of this equipment, the first important choice which had to be made was that of a sensing device or detector. These methods have been described, of which thermal conductivity is the most widely employed:

- Thermal conductivity [1 2]
- Vapor-density-balance (also viscosity)[6 9 10]
- Photometric titration[7 8]
- Surface potential[3 4 5]
- Dielectric constant[4]
- Heat of adsorption[12]
- Infrared absorption[11]
- H_2 Flame. This was described by Dr. R. P. W. Scott, of National Benzole Research Laboratory, at the gas-chromatography symposium in Ardeer, Scotland, May 20, 1955. He used H_2 as the carrier gas and burned it at exit of system. It was then noticed that the flame rose and dropped whenever components arrived at the exit. By placing a simple thermocouple at a given distance from the flame, he was able to realize quite-sensitive detection.
- Ionization detector[13]
- Glow discharge[14]

Detector Requirements

Essentially the detector must meet the following requirements:

1. Good signal-to-noise (or stability) ratio.
2. Small volume to insure fast response and high resolution.
3. Simplicity of operation.
4. Preferably should give equal signal amplitude independently of nature of component to be analyzed.



THIS SCHEMATIC of a vapor fractometer is based on elution-partition chromatography. Carrier gas is regulated and metered. Liquids are vaporized and

NOTE: This is Part 2 of a 4-part series. Part 1 appeared in the June 30 issue of The Oil and Gas Journal. Part 3 will deal with operating variables and Part 4 with applications, in future issues of the Journal.

5. Reasonable in cost.

6. Simple construction.

7. Rugged and stable in operation.

8. Applicable to a broad range of compounds.

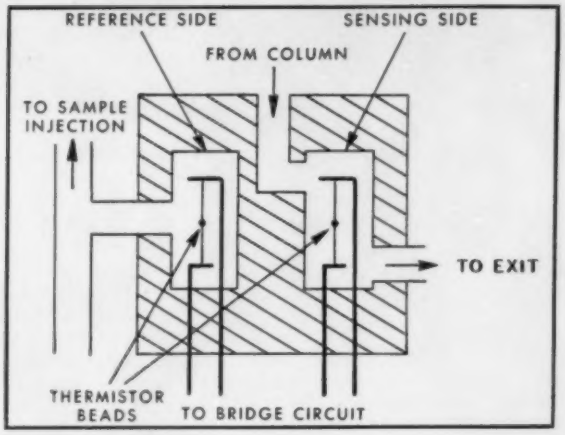
Thermal conductivity cells largely meet all of these requirements when He or H_2 is used as carrier gas and is the most simple and economical detector. Extremely high signal-to-noise ratios have been obtained by minimizing flow sensitivity, drift, temperature sensitivity (improved thermostatting), and by using materials of higher temperature coefficient of resistivity such as thermistors, and helium as a carrier gas.

The vapor density balance developed by Martin apparently provides a sensitivity of approximately 20 times greater than many thermal conductivity cells used abroad. Its disadvantages are that it is a fragile and complex unit, considerably more expensive than thermal conductivity cells.

Photometric titration has been used by Martin on work with amines and fatty acids in the earlier days, but is expensive and restricted in its applications.

The surface-potential detector was investigated by Phillips because of its high sensitivity (about 100 to 1,000 above conventional detectors). Unfortunately, it suffers from nonlinear response with concentration, extreme sluggishness, and irreversibility since components are caught in the detector liquid. This makes this detector unacceptable for quantitative work and general-purpose applications. The signal is also strongly dependent on the nature of the component.

Dielectric constant has also been used for measuring the concentration of components in carrier gas at the exit of the column, but very probably does not meet Requirements 1, 4, 5, 6, and 7.



CARRIER GAS is directed into reference side of dual thermal conductivity cell. Gas stream actually bypasses filament or operates by diffusion. Fig. 2.

The heat-of-adsorption principle has been used successfully in the United States and has been applied to very accurate moisture determinations. However, it does not meet Requirements 4 and 5.

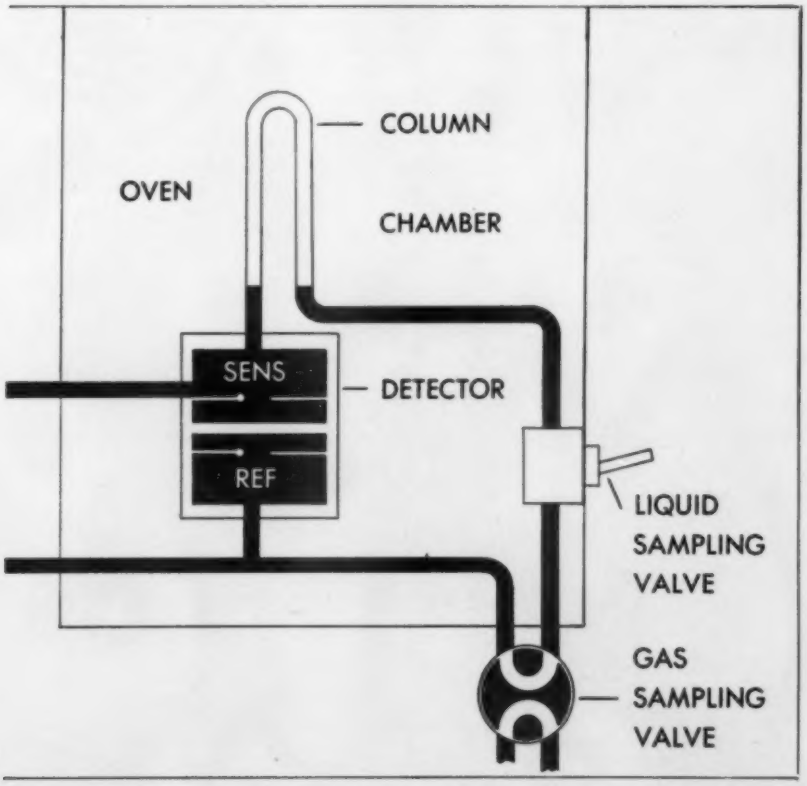
Infrared-absorption techniques have also been investigated in this work and were published by A. E. Martin and J. Smart who connected a complete CO_2 infrared analyzer to a chromatographic system in which components leaving the columns were converted to CO_2 by combustion. This is a rather expensive method. However, it provides attractive sensitivity. On the other hand, it limits application only to components which can be readily converted to CO_2. In general, infrared detection requires large sample volumes to have sufficient component absorption to produce acceptable signal-to-noise ratios. The method, therefore, does not satisfy Requirements 2, 4, 5, 6, and 8.

The flame method discovered by Scott is attractive in sensitivity, simplicity and cost, but requires hydrogen as a carrier gas, which is objectionable from the point of view of safety in routine work. Its quantitative performance is also open to question and probably introduces new factors such as orifice of burner, flow, surrounding atmosphere, and others.

Ionization detector and a low discharge are presently in the experimental stage of development. From this survey, it is apparent that thermal conductivity is the most attractive completed sensing device from many points of view at present.

Carrier Gas

In practice, if thermal conductivity is used as a means of detecting and measuring components appearing at the exit of the column, the choice of a particular carrier gas is made



carried by the gas onto the column. Components of mixture go through column at different speeds and arrive separately at column exit. Fig. 1.

GAS SAMPLES may be metered into the instrument by means of a precision gas-sampling valve. Fig. 3.

to obtain maximum sensitivity by the detector. Thermal conductivities of average organic vapors are approximately one-half of the conductivity of air.

One can, therefore, in the simplest case use clean, dry compressed air or nitrogen. If more sensitivity is desired, a gas should be chosen which has a thermal conductivity considerably higher than air in order to have a greater difference between the thermal conductivity of carrier (or background) gas and component. Thermal conductivities are approximately inversely proportional to molecular weight or specific gravity. The lightest gases, therefore, will provide maximum sensitivity.

Hydrogen is then theoretically the best carrier gas from the point of view of sensitivity. However, hydrogen (which has a thermal conductivity approximately seven times higher than air) is not recommended because of safety reasons.

The next best gas would be helium which has approximately six times the thermal conductivity of air and which is perfectly safe to handle. An average-size gas bottle (200 cu. ft.) of purified nitrogen costs about $16, whereas, helium costs about $18. Such a gas bottle will last several months in daily use. Thus helium is very probably the best choice for the carrier gas.

The carrier-gas flow is regulated by a coarse and fine pressure regulator within a range of 0-30 psig. With a dual-stage pressure regulating system, it is unnecessary to include a flow regulator. (The column in itself acts, somewhat, as a flow regulator and, therefore, helps this situation.) A flowmeter calibrated in centimeters is placed in the stream at this point. The height of a ball float elevated by the helium flow may be translated by means of a calibration chart to yield the flow of helium in milliliters per minute over the range 0-400 ml. per minute.

The carrier gas is directed into the reference side of the dual thermal conductivity cell. Fast response is not important at this stage and the reference side of the detector is merely used to compensate for the carrier gas and major pressure and temperature fluctuations. For these reasons, the gas stream is connected to the reference side of the detector so that it actually bypasses the filament or operates by diffusion. This minimizes flow sensitivity before the entrance to the column where much higher flow-rate fluctuations might be expected (Fig. 2).

The sample should be introduced into the gas stream as close as possible to the column. It can be introduced in two ways:

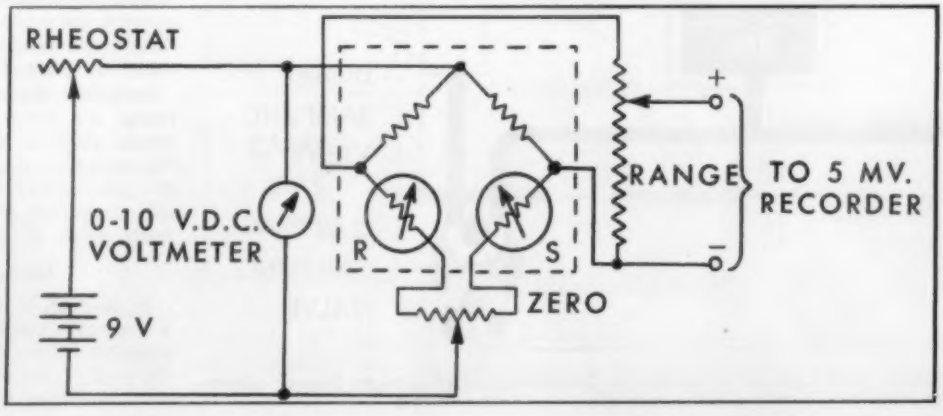
1. A small piece of self-sealing silicone rubber is located on the line leading to the column. By means of a small hypodermic syringe, the sample may be injected into the stream. A small flash heater is provided to insure immediate vaporization of sample. This system is extremely simple and works quite satisfactorily. However, it is somewhat difficult to obtain accurate control of sample quantity since it is difficult to control the amount lost by leakage in the syringe because of the high pressure

COLUMN installed inside thermostatting chamber. In this design oven area can accept U-shaped columns. This design also permits insertion of spiral coil columns of up to 20 m. in length. Fig. 4.

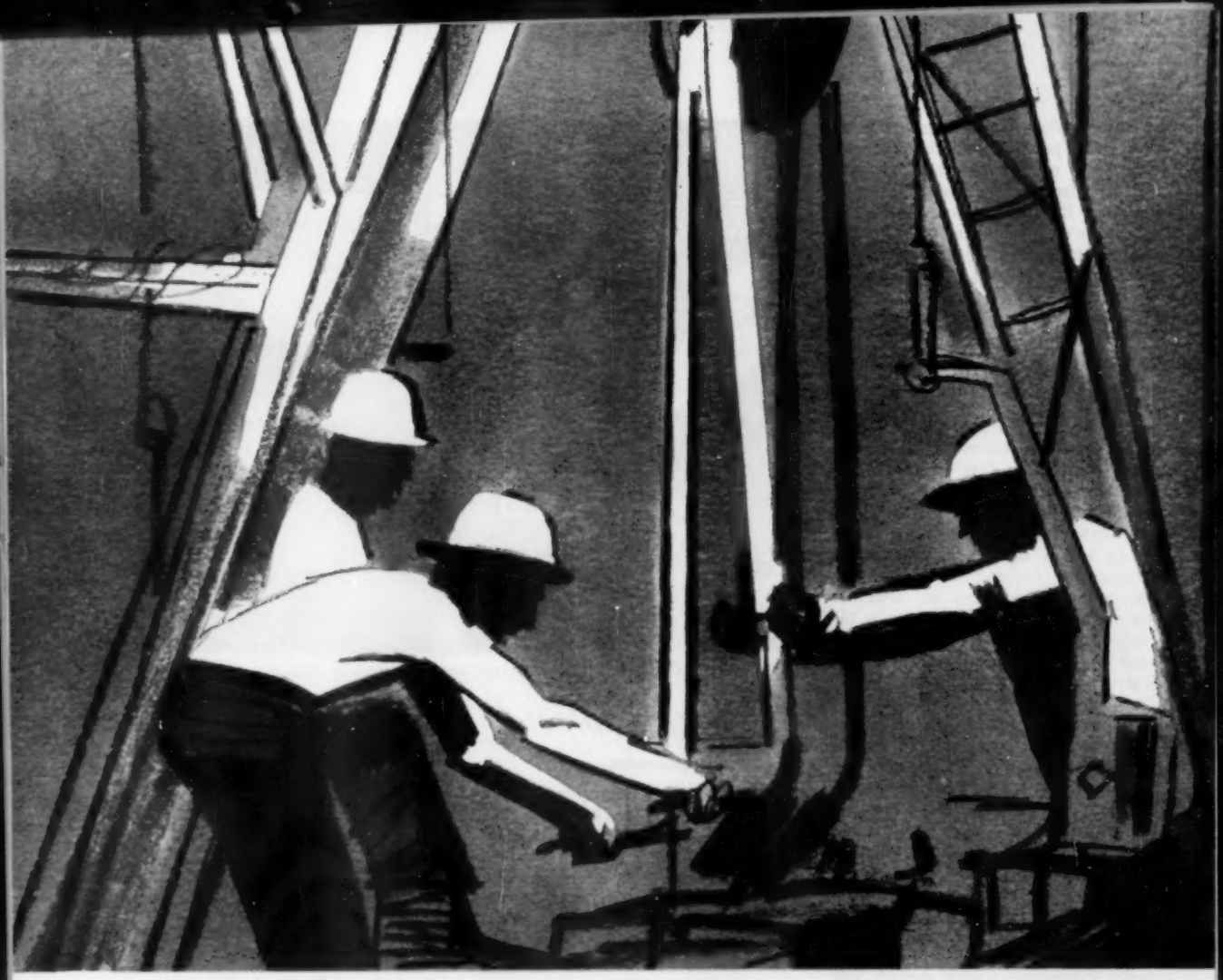
difference in the stream and atmosphere. Unfortunately, liquid sample sizes are generally very small (about 10 microliters) and ordinary hypodermic syringes can not easily be read to this accuracy.

Special accessory microsampling equipment, similar to that used for injection of mass-spectrometer samples, is available for application to problems where high reproducibility of sample quantity is required.

2. Gas samples may be metered into the instrument by means of a precision gas-sampling valve accessory. (Fig. 3) Since gas samples may be reasonably large (¼ to 25 cc.) They can be very accurately measured



DETECTOR CIRCUITS consist of a current adjustment for the two thermistors which are operated at 8.0 volts by standard dry cells. Fig. 5.



Sign of Water....Layne

Vital to most petroleum operations is a guaranteed supply of water. Water for removing heat loads, process consumption and accompanying plant operations—all require determined amounts for an hour, a day, a year—indefinitely. That's why the well site must be accurately determined and the well constructed to deliver the available water.

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by filling a steel loop of fixed volume at a given pressure and temperature (generally room temperature and pressure) from a pressurized sample container. By a simple rotation of the valve the carrier gas is diverted through the sample-filled loop, flushing it into the column.

The Column

Fig. 4 shows the inside of the thermostatting chamber with a column installed. To simplify the process of filling the columns with material to facilitate the construction of "homemade" glass columns by the laboratory worker, the oven area was designed to accept U-shaped columns. In addition this design permits the insertion of spiral-coil columns of up to 20 m. in length if desired. Screw-type fittings are provided for easy interchange or replacement of columns. An extra pair of these fittings is included so that two columns can be used in a series if additional resolution is desired.

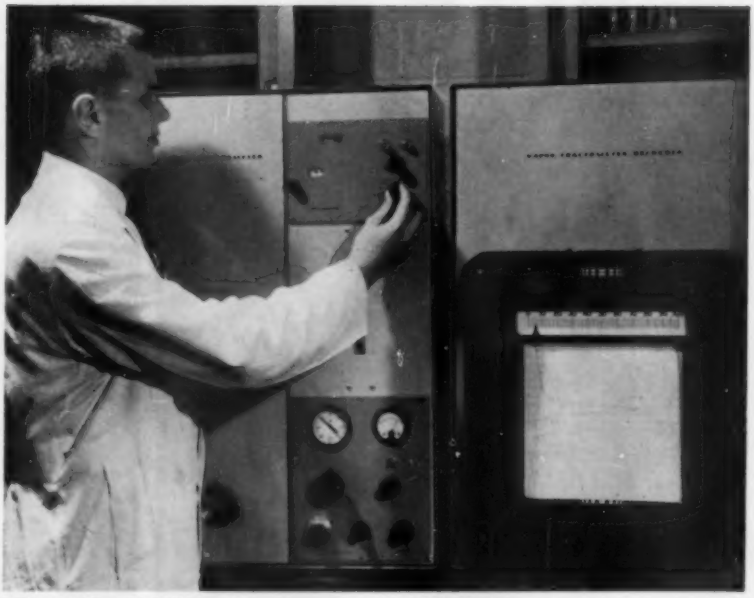
Columns . . . These are made out of Pyrex or stainless-steel tubing, ¼ in. in diameter and 1 or 2 m. long. The columns may be filled with adsorbents or partition agents. In the former, a finely ground (35-60 mesh) activated form of the material is tightly packed into the column.

In the latter, the filling is prepared by dissolving 15-30 parts of a suitable partition liquid in a solvent and adding 70-85 parts by weight of fine (60-100 mesh) diatomaceous earth (celite). The solvent is subsequently eliminated by oven drying.

Packing of the column is done by means of a vibrating tool so that maximum uniformity and compactness can be obtained. The two ends of the column are then sealed by porous stainless steel plugs or with small pieces of glass wool.

The sensing side of the detector is connected directly to the exit of the column to minimize reshuffling of the components as they come off the column. The detector volume (¼ cc.) is kept to a minimum for the same reason. Apparently, a compromise has to be reached in reducing the detector volume. If the volume is reduced much further, sensitivity will be sacrificed since thermal-conductivity measurements are proportional to the layer of gas occurring between the sensing element and walls of the detector.

The sensing side of the detector is connected in a straight throughflow manner to insure faster response and higher sensitivity. Straight throughflow increases the sensitivity to flow but this does not present problems since the flow at the exit of the column is quite constant.



INSTRUMENT HOUSING is a convenient portable cabinet. Fig. 6.

Thermostatting

Both sides of the detector and the columns are enclosed in a thermostatted air chamber accessible by means of a door. The temperature of this chamber may be set directly by use of the thermostat panel-control switch to any desired value in the range of ambient to 225° c.

Power to operate the thermostatting system is further regulated by means of a Powerstat control also located on the panel. This may be used to independently control the temperature of the sample-injection block heater where desired or to vary the cycling rate of the thermostat to yield maximum thermal stability. A blower is incorporated in the oven compartment to insure even heat distribution.

Detector Circuits

The detector circuits (Fig. 5) consist essentially of a current adjustment for the two thermistors which are operated at 8.0 volts by standard dry cells. A zero balance and precision-step range adjustment are also provided. The output of the special bridge circuit used is then connected directly to a standard 5 mv. recorder without need for intermediate amplification.

The instrument is housed in a convenient portable cabinet 30 in. high, 20 in. wide, and 12 in. deep. (Fig. 6).

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• Water? • Gas? • Gas-driven propane?

Which process is best for flooding?

In December, the OGJ reported . . .

An LPG pilot flood project was started in March 1954 in Carter Oil Co.'s C-2 lease block, Seminole City pool, Oklahoma.

Reservoir is Pennsylvanian Booch sand at 3,600 ft.; permeability 30 md.; porosity 18%. Pay thickness is 12-32 ft.; connate water 35%. The wells have produced by solution gas drive. Oil gravity is 36°-38° API. Reservoir oil viscosity is 3 cp.

For the project, reservoir was first repressured with gas to the vapor pressure of propane, and 143,000 bbl. of liquid propane was injected at Wisner G-1 and Sanford G-1.

Gas drive with the propane was started in March 1954, after establishing a water block or barrier of part of the reservoir through water injection into the two W-1 wells.

Following the LPG flood, daily production increased from 13 bbl. per day to a peak of 210 bbl. per day in April 1954. Subsequently, production has gradually declined to 40 bbl. per day.[1]

This followup report now concludes . . .

1. C-2 test has shown that large quantities of liquid propane can be injected into an oil reservoir and gas driven to the production wells without severe channeling.

2. It adequately demonstrated that substantial quantities of oil could be produced by the process at modest propane-oil and gas-oil ratios.

3. Under C-2 test conditions the method is calculated to be more effective than conventional secondary-recovery processes in producing oil.

4. Reduction of oil saturation to low values in portions of the reservoir has been demonstrated.

5. Although unconfinement of the C-2 test has influenced test behavior, projection of test data to confined conditions indicates potential economic usage of the technique. Although the process has limitations, it should be considered where reservoir conditions are suitable and materials are available.

BY R. B. CHAPMAN
Jersey Production Research Co., Tulsa

THE ABRUPT INCREASE in oil production in early 1954, coincident with low gas-oil ratios, indicates clearly the beneficial effect of the propane. By April 1, 1958, 145,000 stock-tank barrels of secondary oil had been recovered. Injection of water at the W-1 wells is responsible for not more than 10,000 to 15,000 bbl. of this total, leaving 130,000 bbl. attributable to the propane.

Although propane production occurred early in the project, it was initially in very small quantities and has never been excessive. The gas drive had been in progress nearly 2 years before the oil-propane ratio decreased to under 2 bbl. of oil per barrel of propane. By April 1958, a total of nearly 77,000 bbl. of propane had been produced, for an over-all oil-propane ratio of 1.9. Gas injection will be concluded this year when coring has been completed.

The presence of asphaltic materials in crude oil did not appear to interfere with oil recovery by the gas-driven propane technique at C-2.

Evaluation of Test

Effect of unconfinement . . . As in most pilot test work, it is desirable to minimize or account for the effects of reservoir unconfinement so that the test can be more rigorously evaluated. At C-2 the water barrier was, therefore, placed across the north end of the test site. Although shale-outs and poorer sand quality in other directions from the test wells provide some confinement, they do not entirely isolate the well pattern.

More complete artificial confinement was not considered practical. Evaluation of the test should thus account for not only the oil, gas, and propane produced at the surface but also that moved to sections of the reservoir surrounding the well pattern.

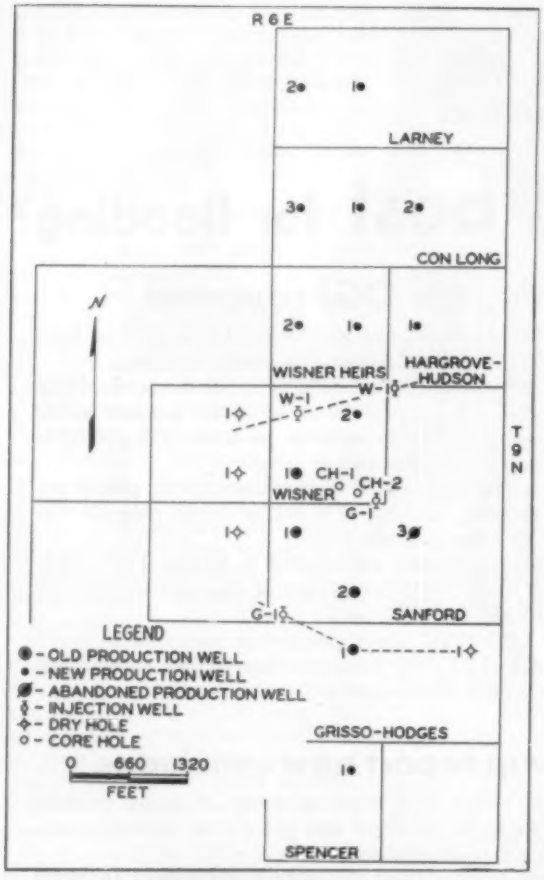
Extra oil . . . Based on reservoir characteristics, it is calculated that about 40,000 bbl. of additional oil might have been recovered from the propane flood had complete test confinement been feasible. If these 40,000 bbl. of oil are added to the 130,000 bbl. produced by the propane (145,000 bbl. less water-flood oil), speculatively about 170,000 bbl. of oil are attributable to the propane drive.

Radioactive gas tracing . . . Radioactive gas tracing is being used in the test area to assist in evaluation of LPG test performance and to study the radioisotope tracer technique. In November 1956, krypton 85 was injected into the Wisner G-1, and tritiated methane into the Sanford G-1. Both are low-energy isotopes and can be handled safely with minimum safeguards against radiation.

Sampling and analysis of produced gases at all wells in the area were started immediately and have continued to the present with gradually decreasing frequency. Some tracer is still being produced but has diminished below peaks at all wells.

The first tracer was produced at the Hodges No. 1, 38 days after injection. Subsequent breakthroughs of tracer occurred at the Wisner No. 1 and 2 and the Sanford No. 1 and 2 after reservoir travel times of 49, 87, 63, and 95 days, respectively. No significant amounts of tracer have been detected north of the water bar-

From paper presented at 11th annual TPRL meeting Austin, Tex.



AN LPG PILOT-FLOOD PROJECT was started at this site at Seminole, Okla., in March 1954. Fig. 1.

rier, indicating the barrier effectiveness.

Special coring and analyses . . . A coring program is under way to investigate what the propane and gas drive did in the reservoir. Objectives are to (1) measure residual oil saturation in the swept portion, (2) determine what portions of the reservoir were contacted by the injected materials, and (3) what influence formation stratification and gravity segregation of fluids may have had on the process. Two core holes have been drilled so far.

First of these core-test wells was drilled in December 1957, on a line between the Wisner G-1 and Wisner No. 1 wells, 450 ft. from the former. Coring was done with a special barrel which maintains pressure during removal from the hole, thus retaining light compounds in the residual oil. Flushing of the core by drilling mud, however, is essentially the same as with conventional coring equipment. The cores were frozen at the surface under pressure, and whole sections were extracted and analyzed.

Fig. 2 illustrates results from Core Hole No. 1. Twenty-two feet of sand were present at this location. Permeability averaged 29 md., which is typical for the field. The 5% propane content in the oil at the bottom of the cored section is normal for the unaffected oil. The propane content of more than 10% in the next few feet suggests excess propane remaining from the process. Zero propane in the top half of the sand indicates that this portion has been swept thoroughly by the driving gas.

Residual oil saturations averaged 19% of pore volume in the top half of the sand, with some as low as 11 to 12%. The lower half measured 26%, which is regarded as a lower limit of probable content, because of washing by the drilling mud. Production testing through casing perforations gave a gas-oil ratio of 100 M.s.c.f. per bbl. in the top portion, all gas in the middle, and a gas-oil ratio of 26 M.s.c.f. per bbl. in the bottom.

The second core hole was drilled midway between Core Hole No. 1 and the Wisner No. G-1 input well. A typical sand section was found, and the cores are currently being analyzed.

Comparison

Based on laboratory tests with C-2 core material and on reservoir engineering calculations, comparisons have been made of the gas-driven propane process with water flooding and conventional gas drive in this type of reservoir.

On a repeated pattern basis, oil recovery by water flooding is calculated at about 100,000 bbl. from the C-2 well pattern. This assumes a combined 75% sweep and stratification efficiency, and a residual oil of 30% pore volume (as determined in laboratory flooding tests) in the flooded portion of the reservoir. It was calculated that conventional gas injection at C-2 would have produced no more than an additional 10,000 to 15,000 bbl. of oil.

Propane . . . These figures contrast with 170,000 bbl., corrected for confinement, from the propane flood. Since water flooding is less expensive to apply, it appears to be competitive economically with the solvent process for the C-2 type reservoir, however.

Reference

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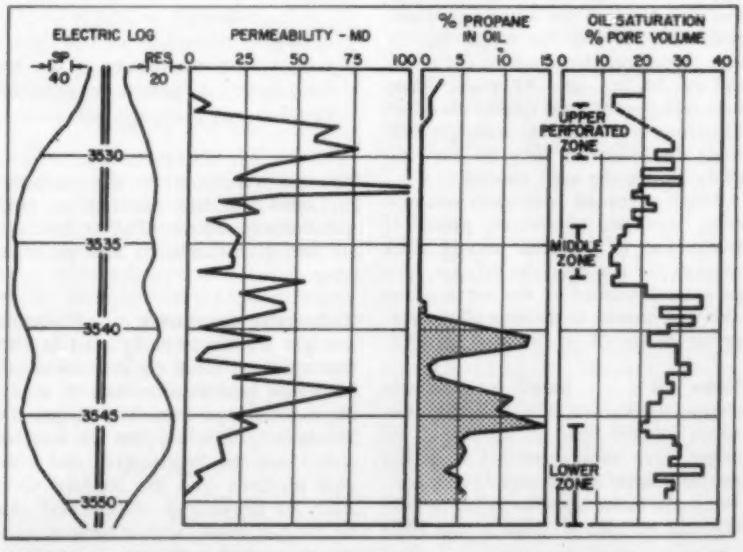
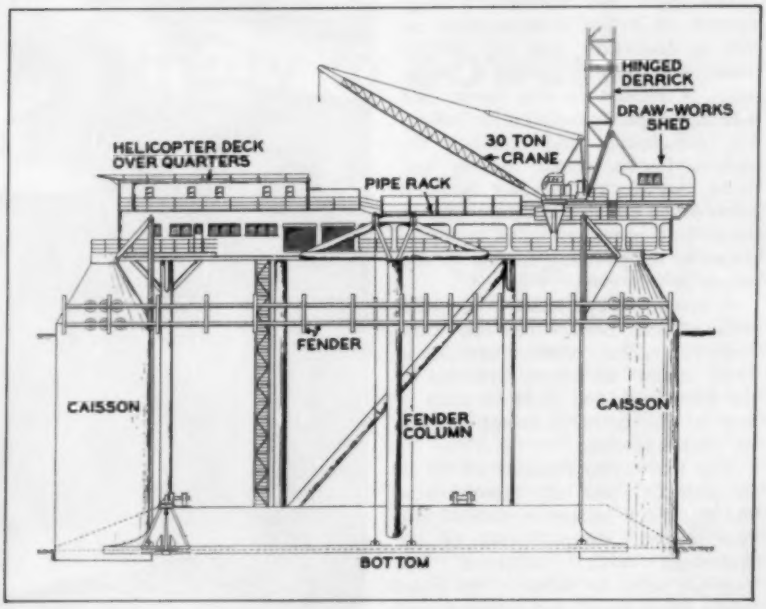


RESERVOIR DATA from first research core hole at the C-2 location shows results of gas-driven propane project. Fig. 2.



The designers of this new floating rig used the successes—and failures—of the past as guides when putting together plans for . . .

The rig that experience built

BY J. L. GOLDMAN
Vice president, Friede & Goldman, Inc.

THE NEWLY COMPLETED offshore mobile drilling unit "Louisiana" besides being a notable addition to this new breed of vessels has an additional degree of significance. The Louisiana marks the end of the early, adventuresome phase of engineering design of mobile drilling units, and initiates a more mature period of design based on experience and development. Anyone regretting the passing of such exciting times, however, can be solaced with the thought that this new maturity applies only to the first 100 ft. or so of water depth. Past this, the pioneer days have hardly begun.

Earlier mobile drilling units were designed and built after searching studies and detailed engineering design and analysis, incorporating new approaches to this relatively new field of activity. Some of the resulting vessels failed in whole or in part. Most were successful in varying degrees. All had lessons to teach the designer and the operator. These lessons of experience became the basis of design for the Louisiana.

While nothing exactly like the Louisiana has put to sea in the past, all principal features have been used individually with success. To the many and conflicting demands made upon a mobile drilling unit, first, as a fully founded floating vessel capable of traversing any ocean under any condition, secondly, setting up rapidly as a fixed island on shifting sands meeting the onslaughts of hurricanes, and thirdly, as an efficient factory for drilling oil wells, the Louisiana has what it takes to do it effectively and economically.

Second Offshore Rig for Owners

The Louisiana is owned by the Louisiana-Delta Offshore Corp., New Orleans, and becomes their second offshore mobile drilling unit. The design, by Friede & Goldman, Inc., incorporates many of their own developments. The builder was the Ingalls Shipbuilding Corp., Pascagoula, Miss., who also prepared the working plans.

The unit has following dimensions:

	Feet
Length over-all	180
Beam molded	151
Depth of hull	12
Slot length	34
Clearance of lowest deck above bottom	83
Working depth of water	65

The unit is of the submersible-hull type with fixed elevated deck, and utilizes corner caissons for stabilizing during raising and lowering. It has been built to ABS class for offshore drilling service.

Lower hull . . . This rests on the ocean floor during drilling operations; is of the highly sloped sided antiscouring design developed (patent pending) by the naval architects. This is the sixth hull to incorporate this feature, which has enabled units so equipped to successfully operate and remain in position when other types of units

have suffered heavy scouring and movement.

The lower hull contains a large number of ballast compartments as well as tanks for fuel oil, drilling water, and potable water. A pump room is located in this lower hull with high capacity facilities for ballasting, deballasting and handling the various liquids stored in the hull tanks. An electric elevator is fitted between the elevated structure and the lower hull, providing quick and easy access to the pumping machinery and valves at all times.

A second escape trunk is provided with vertical ladders between these same two spaces. A scour coaming is fitted around the entire perimeter of the lower hull, and is 36 in. deep in way of the corner caissons and 12 in. deep elsewhere.

The four-corner caissons are 28 ft. in diameter, and are tapered near the top. Each caisson is divided into two separate compartments by the watertight vertical bulkhead. The caissons serve to stabilize the vessel while being raised and lowered, and additionally provide a tremendous reserve of stability while afloat. While being towed in the afloat condition, the vessel has a range of stability and positive righting levers of enormous amount and can withstand hurricane winds and seas with complete safety.

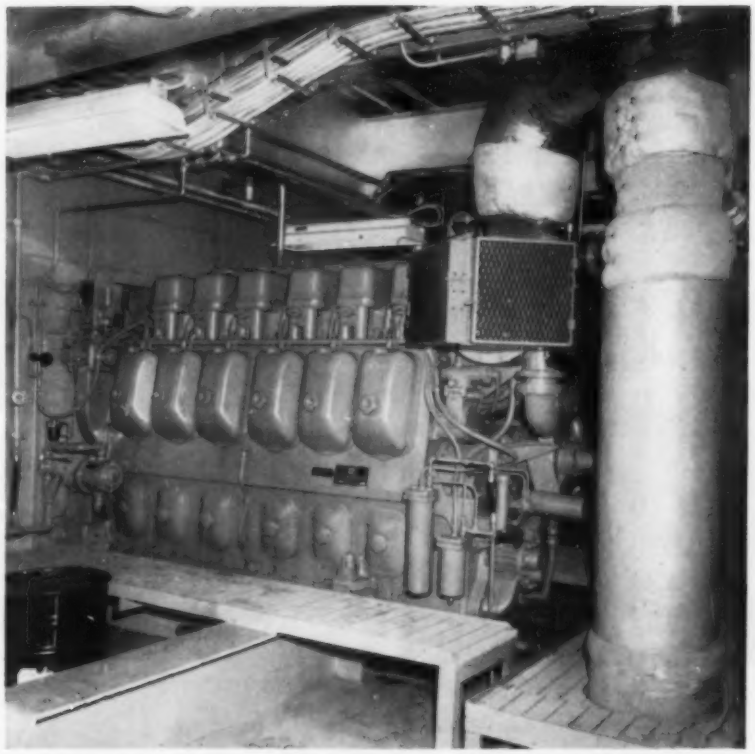
The raising and lowering operations are simple and foolproof, there being no working parts or mechanisms whatsoever. The pumping in or out of ballast water is all that is necessary. For short moves the stability characteristics are more than ample to permit towing the vessel with the hull submerged and raised only a few feet off the bottom. A few simple instructions are sufficient to instruct crew members on how to raise and lower this unit.

The elevated structure provides space for the drilling operations and shelter for the drilling personnel.

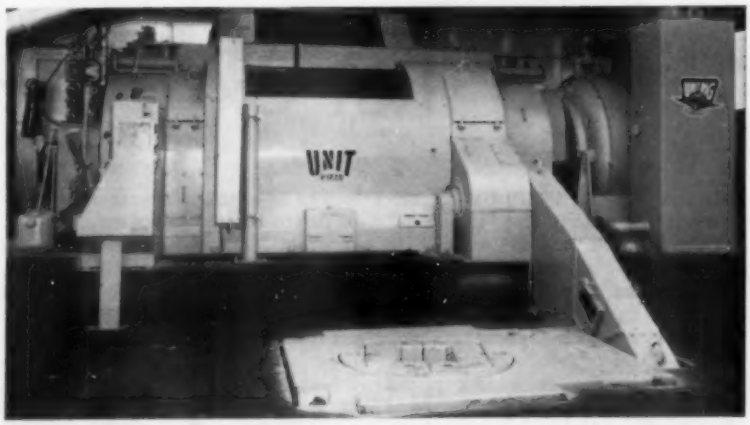
Design of Decks

The lower deck of the upper structure houses the mud pumps, diesel-driven generators, distilling plants, Halliburton unit, mud pits, bulk mud and cement bins, sand trap and shale shaker, bag-material storage and quarters for 16 men.

The upper deck incorporates the drilling floor on which is located the hinged drilling mast, draw works, rotary, pipe rack, Schlumberger unit, quarters for 22 men, office and stateroom for the drilling superintendent, change and washrooms, recreation room, galley and mess rooms, and refrigerated spaces. All living and public spaces are air-conditioned.



MAIN ENGINE ROOM shows one of the three principal engines in the foreground. The three Alco diesel-driven generators were supplied by General Electric Co.



DERRICK-FLOOR view shows the draw works with the rotary in the foreground. Unit Rig & Equipment Co. supplied the draw works.

The deck above these quarters is designed as a heliport.

Principal Items of Equipment and Suppliers

Drilling mast, 140 ft.—1,000,000-lb. capacity, Lee C. Moore.

Draw works, Model 1220—Unit Rig & Equipment Co.

Rotary table, Model 27—Unit Rig & Equipment Co.

Shale shaker, dual type—Thompson Tool Co.

Mud pumps (two), D-1000—Emsco Manufacturing Co.

Diesel generators (three), Alco—General Electric Co.

Ballast and service pumps—Fairbanks, Morse & Co.

Service cranes (two)—Link Belt Co.

Cementing unit—Halliburton Oil Well Cementing Co.

Miscellaneous drilling equipment—Mid-Continent Supply Co.

Anchor winches—Lake Shore Engineering Co.

Byproduct electricity or power?

BY W. L. NELSON
Technical Editor and
Petroleum Consultant

INASMUCH as steam must be produced in every refinery for processing and heating as well as for the operation of some equipment, the power that can be generated by turbines operating on high-pressure steam and exhausting at the main live steam pressure needed in the refinery is considered herein simply as a byproduct. The approximate amounts of power generated for various combinations of steam pressure are indicated in Fig. 1.

The value of the live plant steam (exhaust from the power turbines) is considered to have the same value as the costs determined in Process Costimating Nos. 17 and 18 (June 23, 1958, p. 137 and June 30, 1958, p. 103), and hence the cost of generating power (Fig. 1) consists of only the following:

Extra fuel. About 215,000 B.t.u. per 1,000 lb. steam (about 21% more than for regular live steam if no power generation is practiced. See Process Costimating No. 17, June 23, 1958).

Extra operating labor. The equivalent of about one-half man per shift for each 100,000 lb. steam generation is required for electrical power installations but somewhat less operating labor if only turbines need be tended.

Extra maintenance labor. About 80% of the operating labor (a large percentage because of the small magnitude of the operating labor cost).

Extra maintenance material. Same as maintenance labor.

Extra financial charges. About 10% per year of the replacement value of the power turbines, electrical generators if any, and extra boiler plant costs (about 20%) for the higher pressure, to care for interest, insurance, property taxes, obsolescence, and miscellaneous costs. One-fourth of the capacity is allowed for peak-load operation. The cost of steam turbine generator sets was indicated in Process Costimating No. 17 (June 23, 1958, p. 137), and the cost of steam turbines alone is about 33 to 40% of the cost of steam-turbine generator equipment.

The approximate cost of electricity or of power on such a basis is indicated in Table 1 for the handling of 300,000 lb. steam per hour, or the generation of 10,000 kw.-hr. or 13,400 hp.

TABLE 1
Indication of the Cost (1956) of Byproduct Power or Electricity
(Cents per 1,000 lb. steam*)

Power generation—	20-40 kw.-hr.	27-54 hp.
Extra fuel	10.75	10.75
Extra operating labor	0.47	0.25
Extra maintenance labor	0.38	0.20
Extra maintenance material	0.38	0.20
Extra financial charges	7.30	3.10
Total cost	19.28	14.50

*Extra costs over the cost of plant steam. Process Costimating Nos. 17 or 18, June 23, 1958, p. 137 and June 30, 1958, p. 103.

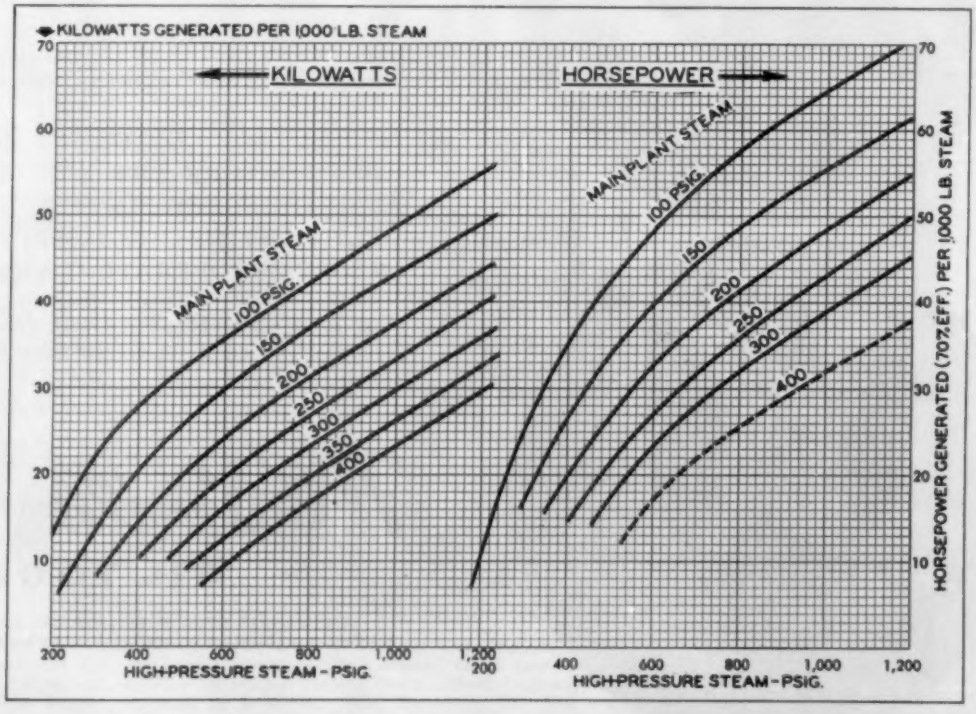


FIG. 1—Byproduct power generation as a function of steam pressures (approximate).

H C Smith 3-CUTTER ROCK BITS

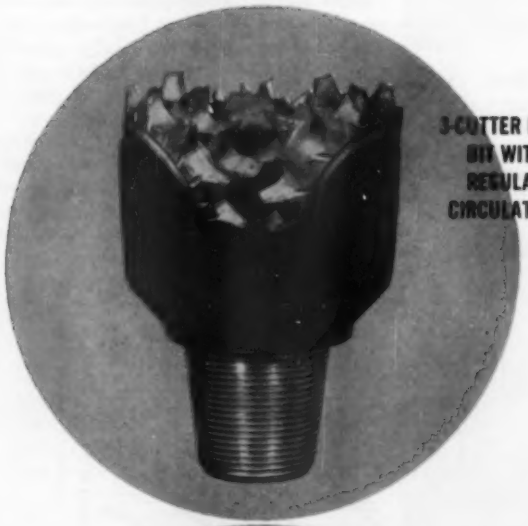
every bit the best

The BEST gives you *Economy* too!

When you figure economy in terms of results obtained per dollar spent, you'll find that H. C. Smith Rock Bits are right up front. For many drillers can tell you that they make more hole – faster and straighter – with H. C. Smith Bits.

There are good reasons why!

COMPACT BODY DESIGN gives H. C. Smith Bits greater clearance between bit and hole wall . . . more room for return circulation to sweep away bit cuttings. Bit teeth stay on bottom, making hole, not just grinding up cuttings. ***That's economy in time!***



3-CUTTER ROCK BIT WITH REGULAR CIRCULATION

ADVANCED ENGINEERING AND QUALITY-CONTROL – the finest in the industry, with steel to our own specifications – make H. C. Smith Bits the toughest and strongest you can buy. ***That's economy in long life!***

PROVEN EFFICIENCY – because all H. C. Smith Bit patterns are field-tested, field-proven in a wide variety of drilling conditions, before you ever get them. ***That's economy in operation!***

3-CUTTER ROCK BIT WITH JET CIRCULATION (new threaded flow nozzles)

H. C. SMITH 3-CUTTER JET ROCK BITS ALSO FEATURE THE NEW REPLACEABLE THREADED FLOW NOZZLE – THE ONLY 3-CUTTER BITS TO PROVIDE THIS IMPORTANT OPERATING ADVANTAGE.

For long life, efficiency and freedom from trouble, you can't do better than H. C. Smith Rock Bits.

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BRANCHES IN ALL PRINCIPAL OIL CENTERS IN THE UNITED STATES AND CANADA

Brown rig makes good initial showing

MIGHTY MOLE, Brown Drilling Co.'s new superlightweight portable drilling rig, completed its maiden well, drilled to 5,320 ft., within less than 2 weeks of the rig's introduction to the oil industry at Bakersfield, Calif.

The initial well was a contract job for Standard Oil Co. of California at Robert's Island, in the Sacramento River island country, about 9 miles west of Stockton.

Arthur J. Heiser, Brown vice president, said the rig performed better than expected on its break-in job. Careful power checks during the operation showed 478 hp. going to the pump on the new equipment.

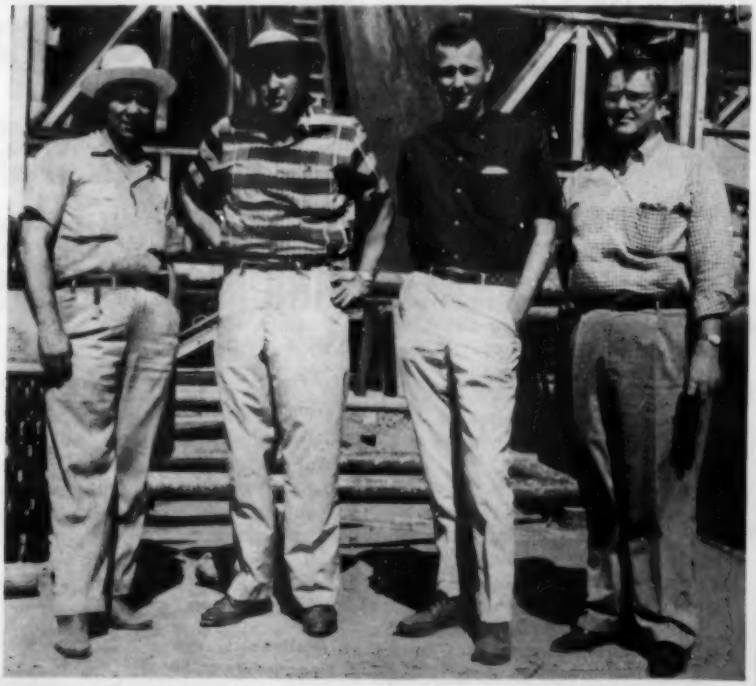
Brown's tool pusher on the rig was W. W. Lipscomb. General supervision was by Al Albiston, drilling superintendent.

Use of lightweight alloy metals wherever possible, and other weight-saving features of design make the assembly one of the lightest, most portable, and most powerful rigs in existence for its depth capacity.

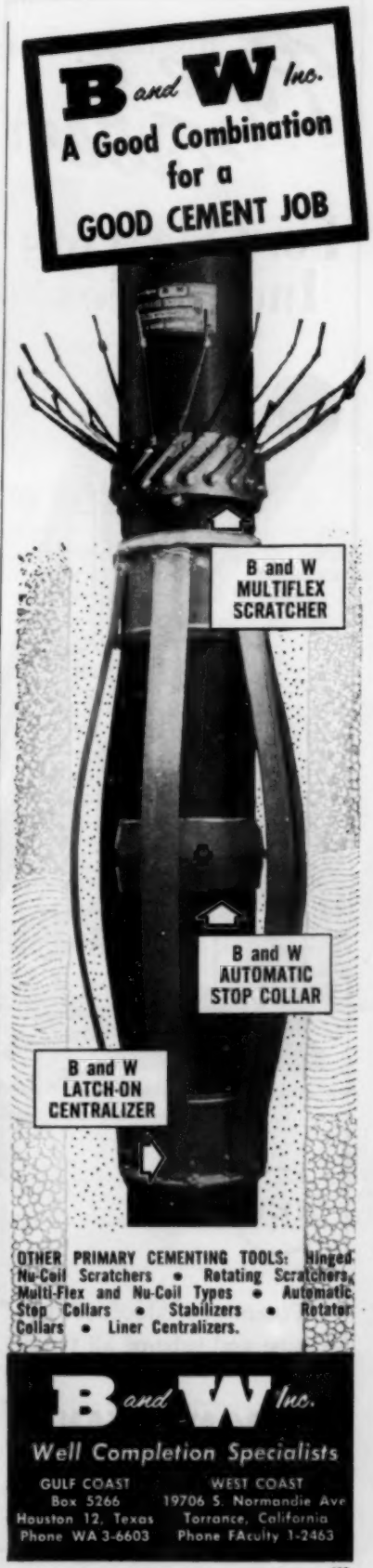
The rig uses turbosupercharged diesel engines. Horsepower development was over original estimates. The assembly moves in 13 trailer loads. Only two of these, the draw works and mast trailers, require highway permits.

Who's getting the drilling contracts

Ray Smith Drilling Co., Dallas, is making hole on a new remote wildcat it is contracting for Carter Oil Co. on the latter's Fear Ranch unit in Wyoming's far-western Sublette County. The location, in 13-32n-113w, is 12 miles from nearest production in



ON THE JOB at Oklahoma's deepest test are, left to right: Cap Triplett, drilling foreman, Shell Oil Co., operating company; Ray Marsh, relief tool pusher, Helmerich & Payne, Inc., drilling contractor; Harold Pruner, Shell engineer; and C. C. Littlefield, district manager of Sperry-Sun Well Surveying Co. The well, Shell's 5 Rumberger, exploratory test in Elk City field, Beckham County, is drilling below 21,200 ft. Present depth objective is 22,000 ft., or the Morrow formation.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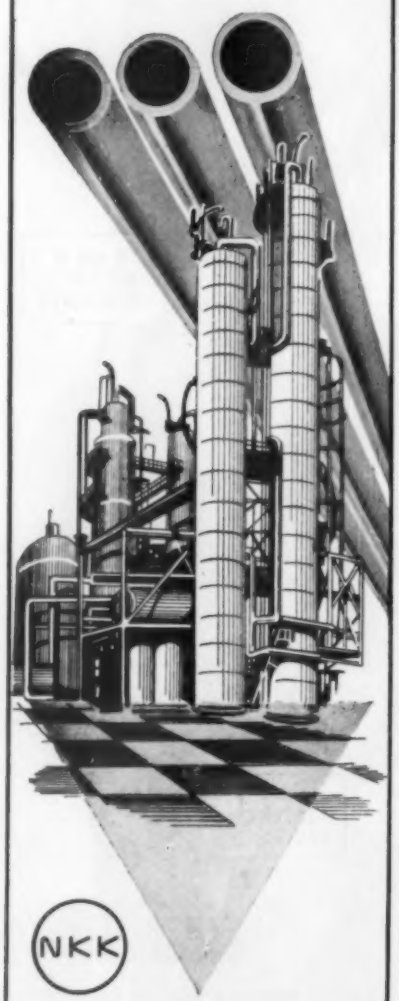

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Cable: STEELTUBE TOKYO

the Deer Hill and Big Piney areas. Drilling is scheduled to go to the Mesaverde about 9,300 ft.

Hunt Drilling Co., Corpus Christi, has a rig working for W. M. Keck, Jr., at a wildcat location 2½ miles south of Wharton, in Wharton County, Texas Gulf Coast. Location, at 1 Oswald Ullman, in the Francis Biggam Survey, is about 5 miles north of North Withers field, nearest production. A 7,000-ft. test is planned.

Pioneer Oil & Gas Co. has taken on a contract job in St. Mary Parish, Louisiana Gulf Coast. It is a 10,000-ft. test for South Louisiana Production Co., of Lafayette, La. Location, at 1 Bergeron, in 21-15s-12e, is about 3 miles west of Morgan City. It is 2½ miles northwest of Bateman field, and about 2 miles southeast of nearest production at Patterson.

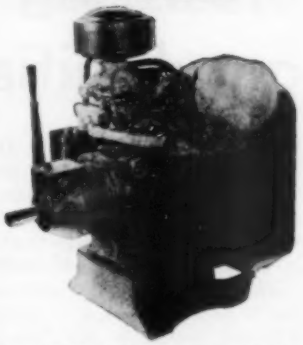
Circle Drilling Co., Lake Charles, La., is on a new wildcat operation southwest of Richie field, in northwestern Acadia Parish, South Louisiana, where it is drilling for Vincent & Welch and George McGhee. The test, 1 Frank Dupree, in 30-7s-1w, is about a mile from production at Richie, and about 2 miles east of Tepetate field. Permit is for 9,000 ft.

Brazell Drilling Co. is contractor on a distant wildcat test Davis Oil Co. is undertaking in northeastern Johnson County, on the upper west side of the Powder River basin, northern Wyoming. It is a 7,200-ft. Parkman test at 1 Federal-Walker, in 12-50n-78w. Nearest production is about 12 to 15 miles east in the Barber Creek and Dead Horse Creek fields.

L & F Drilling Co., Bakersfield, Calif., has a rig working for Trico Oil & Gas Co. on a deeper-pay exploratory test in the Santiago Creek area of the old Midway-Sunset field, Kern County, California. Location of the well, 51A-17 Havenstrite-USL, is about 2½ miles southeast of Maricopa. Objective is the Leutholtz zone, expected about 6,000 ft.

Inca Drilling Co. has two new contract operations getting under way for Beck Oil Co. in South Louisiana. Both are at wildcat locations, one in Lafourche Parish, and the other in Calcasieu Parish. The former is a 13,000-ft. job. Its location, at 1 Caldwell, in 74-14s-16e, is about 2 miles north of Thibodaux and more than a mile from production. The other, with a 10,500-ft. permit, is at 1 Edgewood, in 29-7s-10w, about 1½ miles north of Perkins field.

WIND WHEEL ENGINE



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This week's SHOWCASE features . . .

Liner mill drills up pipe fast

. . . during remedial or workover operations. Interchangeable blades are used. They fit a wide range of bodies for use in different sizes of pipe. The blades may be easily and quickly replaced with tools found on a drilling rig.

Incorporated in the replaceable blades are: (1) end extensions for drilling packed accumulations in the pipe to be cut, (2) guide surfaces for piloting within the pipe, (3) a substantial length of cutting section faced with sintered tungsten-carbide aggregate, and (4) a protective bearing surface to prevent cutting-section contact with the casing through which the tool is run. **Write or call: Kinzbach Tool Co., P. O. Box 277, Houston, for details on Pilot Speedmill liner mill.**

●

Hydraulic-set, retrievable packer

. . . can be used in single or multiple-zone completions. It's available in standard casing sizes for single, dual, triple, and quadruple-string installations. Any number of single or multiple-string packers can be run on the number 1 tubing string. All other tubing strings are then run and landed. The wellhead is then installed with the completion fluid in all strings and the annulus.

With the well under positive control, well fluid is changed over as desired and all zones washed in. Packers can then be set simultaneously, or set and tested individually. No wire-line manipulation is required in the setting procedure, the maker says. There is no tubing movement while the packers are set. Tubing strings are landed in tension to assure free running of wireline equipment. A special jaw-clutch arrangement built into the packer is used as torque jars in pulling the packer after the hydraulic pressure has been released from the cylinder. **Write or call: Brown Oil Tools, 2216 Campbell, Houston 10, for details on hydraulic-set, retrievable packer.**

Seismic field-recording system

. . . makes one-package, portable unit. The new SIE MS-15A equipment for field magnetic recording and monitoring is housed in a single sturdy unit. No darkroom facilities are required. The unit can be installed in a portable recording cab or in a pickup truck or marsh vehicle.

Designed to provide magnetic records for the SIE MS-12 GeoData system, it uses the high-fidelity frequency-modulation method for reproduction of field seismic signals. Except for geophones, the MS-15A is a complete field recording and monitoring system.

The unit produces high-fidelity FM recording from 54 broad-band, linear phase-shift, seismic-amplifier FM modulator combination channels. Traces can be observed before recording for noise level and relative trace amplitude. Either pen-and-ink or electrostylus presentation methods provide a record 2½ minutes after a shot has been fired. **Write or call: Southwestern Industrial Electronics Co., 2831 Post Oak Road, P. O. Box 13058, Houston 19, for details on SIE MS-15A magnetic recording system.**

Send this Showcase Coupon

to the Manufacturer of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

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Described in OIL AND GAS JOURNAL - Issue of July 14, 1958

NAME.....TITLE.....

COMPANY.....

ADDRESS.....

CITY.....STATE.....

DATE.....

Trencher cuts 8-in. ditch

. . . 30 in. deep. The Model M2 Ditch Witch trencher's features include a new speed-reduction unit with Select-O-Matic shift from digging speed to mobile speed. It provides four speeds forward and one reverse, as well as optional features.

Optional features include a sod-cutting attachment. This attachment can be mounted on the trencher in minutes. It cuts an 8-in. sod strip at speeds up to 40 ft. per minute. After trenching and backfilling, the sod can be replaced, leaving turf with an "untouched" look. **Write or call: Charles Machine Works, Inc., 671 Birch Street, Perry, Okla., for details on Model M2 Ditch Witch trencher.**

Packaged production unit

. . . operates oil leases automatically. The field installation of the Graver IPS unit shown handles 1,000 bbl. of oil per day with 20-minute weathering time each cycle. The unit is designed for lease automatic custody transfer. It performs a number of functions.

It automatically runs crude oil from the well through the production equipment into the pipeline on a predetermined schedule, unattended. While doing that, it rejects oil with an excess water content and sends it back to the treating equipment. It shuts down production when the lease allowable has been produced or when power failure occurs.

The unit measures and records the quantity of crude oil run to the pipeline. Measurement is done in a calibrated meter tank after a predetermined weathering time. It also takes and stores a proportional sample of crude-oil run and records its temperature during the run.

Components consist of: (1) a calibrated meter tank available in various sizes with a float chamber containing float switches, (2) transfer pump, (3) b.s. and w. monitor probe, (4) sampler, and (5) valves unitized and piped on a skid for portability. The unit includes all necessary electrical wiring and explosionproof accessories on the skid and a battery-control panel and cable for remote mounting. **Write or call: Graver Tank & Mfg. Co., Sand Springs, Okla., for Bulletin IPS-1.**

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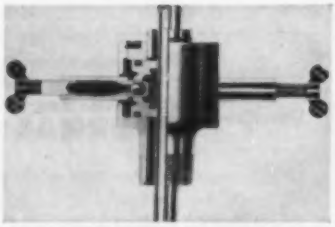

Stuffing box for polished rod

. . . assures free lateral movement of the floating gland, the maker reports. Designated as Type 241, the stuffing box has been tested under severe field-operating conditions. Lateral movement of the floating gland compensates for any misalignment of the polished rod. The gland is packed with self-lubricating plastic packing. It will not adhere to the rod or burn out if the well pumps off, the maker reports.

Additional packing may be inserted into the stuffing-box gland through lateral tubes at any time without shutting in a well. This permits a fully-packed gland to be maintained. A wear bushing is provided and sized to prevent contact of the polished rod with tubing and fittings. It reduces wear and damage to these parts. **Write or call: Kinzbach Tool Co., Inc., 2411 Summer Street, P. O. Box 277, Houston, for details on Type 241 stuffing box.**

•

Control valve regulates small flow

. . . of liquids and hard-to-handle gases. The valve comes in two types—throttling (Type 57), and two-position (Type 44) models. Both are designed to control extremely small flows of liquids and such hard-to-handle gases as nitrogen, oxygen, and helium at pressures to 10,000 psi. and temperatures from —65° to 400° F. Construction can be modified for temperatures from —400° to 1,000° F.

Air-to-open and air-to-close, as well as line and panel-mounting hand-control versions are available. Designated as Series 200, the valves have a maximum shutoff rating of 6,000 psig. without leakage. Full valve travel is accomplished in less than 2 seconds.

All valve models have split-body construction. Seat rings are in the lower half of the body. Body sections can be assembled to attain straight-through or angle line connections. The bodies are made from forged stainless steel. They have ½ or ¾-in. NPT end connections. The plug is a single-seated contoured type with linear flow characteristics. **Write or call: Minneapolis-Honeywell Regulator Co., Valve Div., 2753 Fourth Avenue, Minneapolis, for details on Types 57 and 44 control valves.**

BAKER DIFFERENTIAL FILL-UP EQUIPMENT HAD "WHAT IT TAKES" FOR RECORD 7,898-FOOT 13⅜-INCH CASING STRING

Inclusion of a Baker Differential Fill-Up Shoe and Collar in their plans for the longest string of 13⅜" casing ever run paid off for Howell and Howell in their Andarko Basin No .1. The record 7,898-foot string was landed without incident, dramatically demonstrating the advantages, reliability, and safety of Baker Differential Fill-Up Equipment.

For record or routine wells Baker Differential Fill-Up *automatically* fills the casing, eliminating the lost time and inconvenience of surface filling. It gets the casing to bottom fast, at the same time providing the protection of a back pressure valve that can be made operative at any time.

Because Differential permits the casing to fill at the same rate as it is lowered, weak zones are protected from breakdown or mudding off; the natural formation characteristics for a successful cement job are preserved.

Apply *automation underground* to your casing running and cementing operations through use of Baker Differential Fill-Up Equipment.

Available at your Supply Store.

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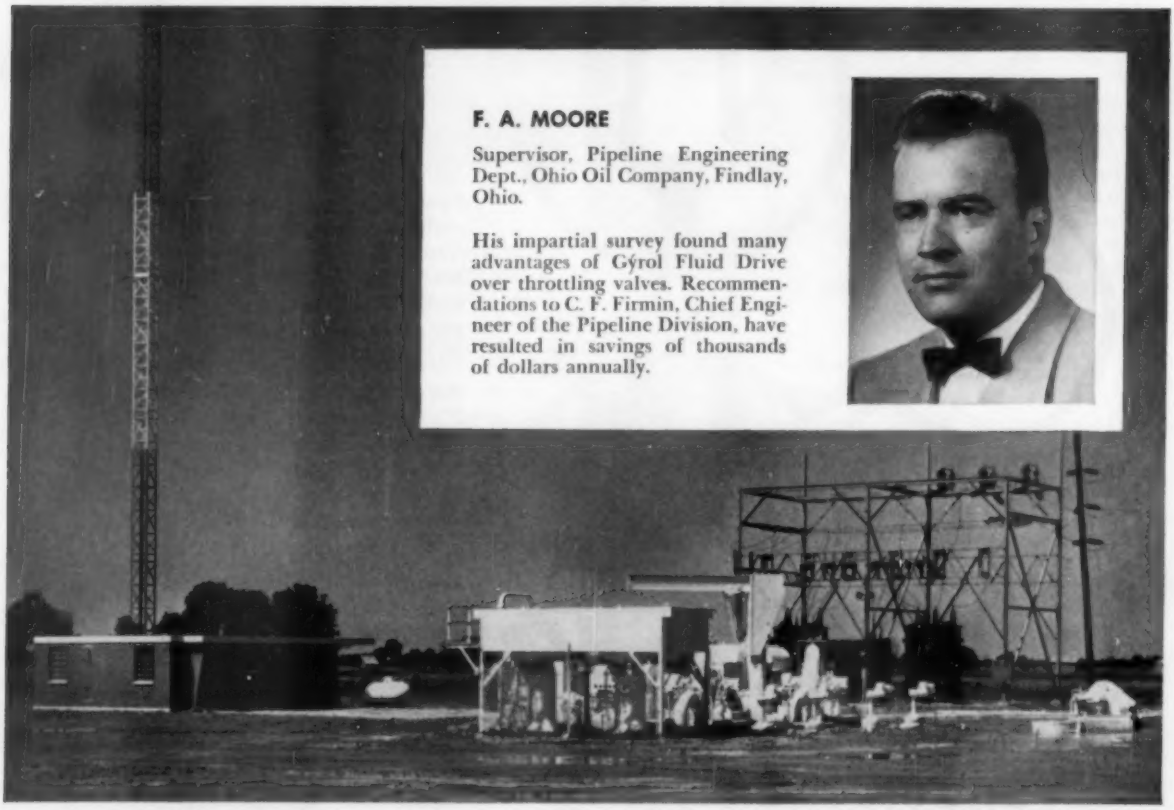
HOUSTON · LOS ANGELES · NEW YORK

MARATHON

AMERICAN BLOWER *Gýrol.* Fluid Drive

REDUCE PIPELINE

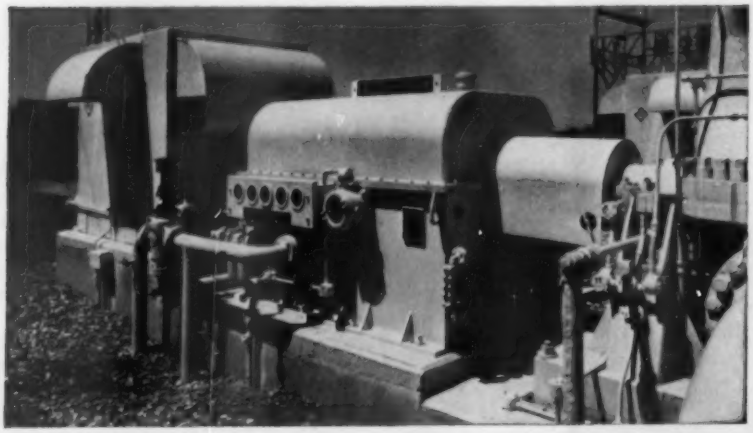


F. A. MOORE

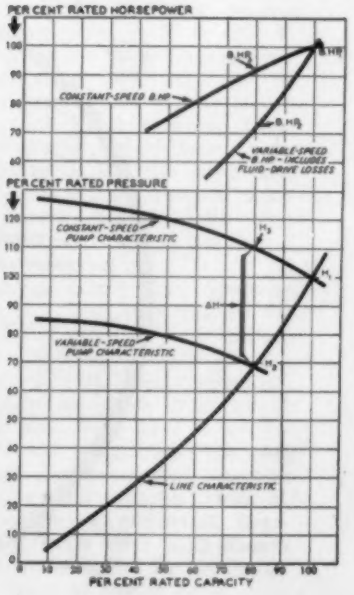
Supervisor, Pipeline Engineering Dept., Ohio Oil Company, Findlay, Ohio.

His impartial survey found many advantages of Gýrol Fluid Drive over throttling valves. Recommendations to C. F. Firmin, Chief Engineer of the Pipeline Division, have resulted in savings of thousands of dollars annually.

Ohio Oil's Roachdale, Ind., pumping station.



Gýrol Fluid Drive is installed outdoors at the Roachdale station, an automatic, unattended crude-oil booster station. The unit pictured consists of a 2,500-hp 1,800-rpm motor, a class 6 Gýrol Fluid Drive, and a centrifugal pump.



Graph shows how pump BHP varies as the cube of the speed, while Gýrol Fluid Drive efficiency varies directly as the ratio of output to input speed. Result: major power savings over throttling whenever pump runs below full speed.

helps Ohio Oil Company

POWER COSTS 10%-25%!

Adjustable-speed *Gýrol.* Fluid Drive saves power; gives complete flexibility of flow and pressure

Power savings of $10,000-$12,000 *annually* have resulted since Ohio Oil Company, Findlay, Ohio, equipped its Jewett, Ill., automatic pumping station with American Blower Gýrol Fluid Drive.

Infinitely adjustable in speed, Gýrol Fluid Drive controls flow and pressure in a 10-in. closed-system products line. By eliminating wasteful throttling, it maintains throughput with lowest possible power consumption.

An 8-stage centrifugal pump is driven by a 900-hp, 3,600-rpm induction motor through Gýrol Fluid Drive. This combination brings these operating benefits:

- Single unit provides complete flexibility, regardless of rate of flow required by changes in viscosity or specific gravity.
- Motor starts under no-load conditions, reducing "soft line" demand charges.
- Pressure surges in line are eliminated.

In addition, American Blower Gýrol Fluid Drive:

- Holds pressure below design pressure of line.
- Maintains minimum suction pressure.
- Adapts easily to unattended operation.
- Offers dependability proved by hundreds of continuous-duty pump applications.

For full information on the pipeline-pumping savings possible with Gýrol Fluid Drive, contact one of our 73 branch offices. Or write: American-Standard*, American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

Dependable Gýrol Fluid Drives have satisfied the automation needs of power plants for years; are ideal for remote-controlled pumping stations. Class 6 Gýrol Fluid Drives are available from 250 hp to 12,000 hp; speeds to 3,600 rpm.

* American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation.

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AMERICAN BLOWER DIVISION

Gýrol Fluid Drive Dept. 10
American-Standard
American Blower Division
Detroit 32, Michigan

Gentlemen:

☐ Please send information on Gýrol Fluid Drive for pipeline pumping stations; ☐ Have an American Blower representative call.

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Here's the easiest way to eliminate your weed hazards—safely—economically! This dust-free granular weed killer controls both broad-leaf and grassy weeds... for a full season! You just apply UREABOR *dry*... there is nothing to mix—no water to haul. It works in all climates... in wet or dry areas. Rates of application are low; as little as 1 to 2 lbs. per 100 sq. ft. That's because UREABOR is a compound of two powerful plant-killers. It is noncorrosive to ferrous metals and nonflammable.

This Spreader simplifies and speeds application...

The PCB Spreader applies UREABOR to best advantage at prescribed low rates. It holds enough UREABOR to treat 1250 to 2500 sq. ft. without refilling—weighs a mere 6 lbs. Available now for just $10.75 delivered anywhere in the U.S.A.

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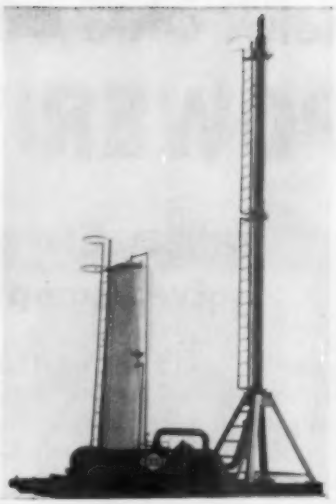


Hydraulic pump for oil wells

. . . has long stroke and a polish-rod capacity of 36,000 lb. The unit can pump six 27-ft. strokes per minute. Stroke length may be reduced by 1-ft. intervals to 23 ft.

The Model H36-27 pump unit requires only one startup step. It has a large air-volume counterbalance tank to minimize variation during the stroke cycle and a direct-actuated and reversing valve. All oil in the unit is continuously filtered.

The air compressor and scavenge pump may be run independently to charge the system with air or oil without operating the main pump. The front crossmembers are easily removed for well servicing. **Write or call: Cabot Shops, Inc., Pampa, Tex., for details on Model H36-27 pumping unit.**

•

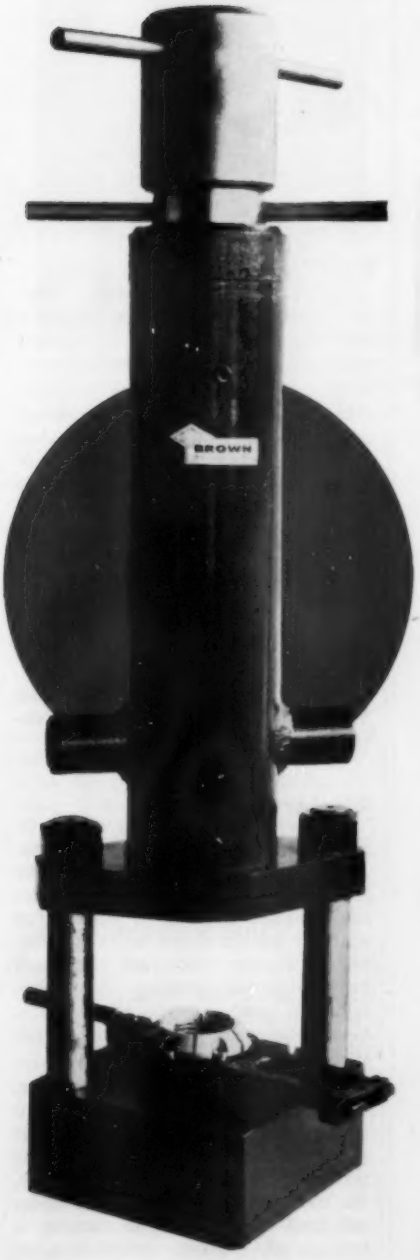
Dual-completion christmas tree

. . . is capable of handling two strings of 3½-in. tubing in a 5⅝-in. casing. The tree consists of: (1) a McEvoy Type-S casing head with a controlled-friction casing hanger; (2) an S4H head for suspension of tubing; (3) two dual master valves; and (4) a flanged tee with two 3-in. wing valves.

The all-purpose intermediate casing or tubing head is equipped with a pad. It may be threaded to accommodate down hole shutoff valves without disturbing other casing annulus outlets. **Write or call: McEvoy Co., P. O. Box 3127, Houston 1, for details on dual-completion christmas tree.**

Brown Introduces Tool For Well and Personnel Safety...

The TUBING BLEED-OFF ASSEMBLY



The Brown Tubing Bleed-Off Assembly was designed with one purpose in mind . . . to provide SAFE operations while pulling sanded-up or plugged tubing.

When pressure trapped between bridges makes normal tubing pulling operations unsafe, this device may be used to insure control of the well at all times. The Tubing Bleed-Off Assembly eliminates the possibility of damage to the well, rig or workover equipment, and the operating crews.

The advanced and outstanding features of this tool provide:

- Safety to operating personnel since the tubing cannot blow out of the hole
- Control of the well to prevent "blowouts"
- Controlled flow of fluid from the tubing
- Method of keeping rig floor clean when tubing unloads
- Means of directing produced fluid to storage area or facilities
- Rig safety since oil is not allowed to unload from tubing onto the motors
- A means of circulating the well to control it or kill it
- A means of accurately locating bridges by use of a pressure gauge and guesswork is eliminated

The assembly is basically a pressure-tight mud-box with seals which hold in both directions. Outlets are provided between the seals to allow for controlled "bleeding-off" of trapped pressure, and to allow for circulation back into the hole to "kill" the well.

The assembly is constructed with external upper seal and lower seal pack-off around the tubing to control trapped pressures when the tubing joint is broken between bridges. Two side outlets provide a means of connecting a pressure gauge, and, if desired, a flow line, between the seals.

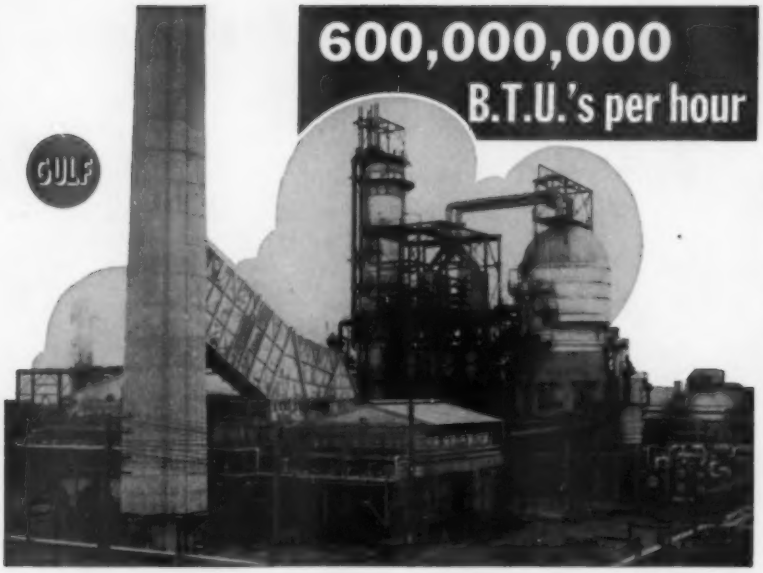
The square bottom plate is designed to fit into the rotary table and is internally machined to accommodate standard tubing slips. A slip segment in the upper portion of the tool holds the tubing once the connection is broken and prevents the tubing from "blowing out of the hole." When the connection is broken, the upper portion of the tool, containing the upper seal, is free to rotate with the tubing. It is designed for either 2" or 2½" nominal tubing.

The Tubing Bleed-Off Assembly is another in the long list of "firsts" by Brown Oil Tools. Each tool manufactured or put in service by Brown is designed for maximum safety of the well, equipment and personnel. Additional information on this new tool can be obtained by contacting the nearest Brown representative. Or write Brown Oil Tools, Inc., P. O. Box 19236, Houston 24, Texas.

BROWN
OIL TOOLS, INC.

8490 Katy Road, Houston, Texas.

MWL Tool & Supply, Midland, Texas, and Hobbs, N. Mexico; Regan Forge & Engr. Co., San Pedro, Calif.; Consolidated Service Co., Casper, Wyo. Acme Well Supply, New York City; Import Tool Co., Edmonton and Calgary, Alberta, Canada; A-Z Export, S.A., Maracaibo and Puerto LaCruz, Venezuela; Miguel Rocca, Mexico City.



Forty-eight NATIONAL AIROIL Tandem Units fire Gulf's huge Crude Heater at Philadelphia.

with NATIONAL AIROIL'S *Exclusive* TANDEM COMBUSTION UNITS

This tremendous Combination Atmospheric—Vacuum Crude Heater at Gulf Oil Corporation's Philadelphia Refinery, was constructed by Foster Wheeler Corporation . . . for a total burner liberation of up to 600,000,000 B.T.U.'s per hour.

NATIONAL AIROIL *exclusive* Tandem Combustion Units achieve this capacity with maximum economy and availability.

These NATIONAL AIROIL oil burners are *all-alloy* for burning high temperature pitch separately, or in conjunction with non-aerated gas burners. Additional burners are also provided for waste gas disposal.

NATIONAL AIROIL Tandem Units are recognized as standard firing equipment in oil refinery and chemical plant heaters throughout the world. They are noted for versatility regarding fuels; and insure correct flame placement so necessary to avoid damage to the heat-absorbing tubes. Your furnace maintenance problems are measurably reduced, and hours on stream greatly increased by use of Tandem Combustion Units.

Further information sent upon request on your letterhead.

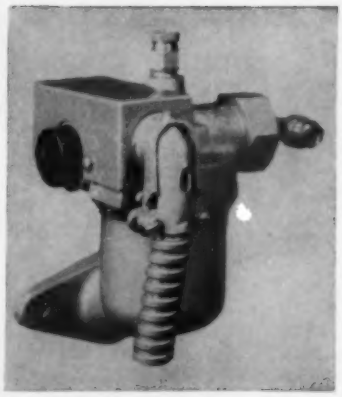
OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes; STEAM ATOMIZING OIL BURNERS; MOTOR-DRIVEN ROTARY OIL BURNERS; MECHANICAL PRESSURE ATOMIZING OIL BURNERS; LOW AIR PRESSURE OIL BURNERS; GAS BURNERS; COMBINATION GAS and OIL BURNERS; AUTOMATIC OIL BURNERS, for small process furnaces and heating plants; FUEL OIL HEATERS; FUEL OIL PUMPING and HEATING UNITS; FURNACE RELIEF DOORS; AIR INTAKE DOORS; OBSERVATION PORTS; SPECIAL REFRACTORY SHAPES.

CHEMICAL PETROLEUM DIVISION

National Airoil
BURNER COMPANY, INC.

Main Office & Factory: 1236 EAST SEDGLEY A[illegible], PHILADELPHIA 34, PA.

SOUTHWESTERN DIVISION: 2512 SOUTH BOULEVARD, HOUSTON 6, TEXAS



Oil monitor protects compressor

. . . by preventing recycling when the compressor - crankcase oil-level falls below a safe limit. It is standard equipment on 1958 Champion stationary and portable air compressors.

Called the Oil Monitor, the device employs a microswitch which makes it impossible for the compressor to start a new cycle unless enough oil is present for proper lubrication. Recycling can only be accomplished by manually pushing a button on the side of the monitor. Even then the compressor will cut off automatically at the next cycle. And it continues to do so until oil is added to bring the crankcase level up to normal. **Write or call: Champion Pneumatic Machinery Co., Princeton, Ill., for details on Oil Monitor.**

Rig for servicing and workover

. . . built strong yet portable. The Model T420-38 rig has a full-width cab mounted forward to provide full visibility for the driver when roading. Other features cited are: air road brakes, power steering, headlights, taillights, turn signals, wheel flaps, horn, rear-view mirrors, and windshield wipers on all front glasses.

The unit is powered by gasoline, LPG, or diesel engines. The drums are driven through a torque converter and planetary transmission. Providing three speeds forward and one reverse, the transmission can be shifted under full load with the engine running at full speed without declutching or slowing down, the maker reports. A torque-tube drive extends from the transmission to right-angle gears. The final drum drive is by slow-speed roller chains.

Controls are arranged for either ground or platform operation. The rig is available with a 66-ft. doubles

SHOWCASE . . .

New Equipment

derrick which requires no load guy lines to the ground, or with a telescoping mast. **Write or call: Fred E. Cooper Co., Box 1890, Tulsa, for details on Model T420-38 rig.**

●

Manhole is nonlocking type

. . . designated to eliminate use of oversized manholes in applications where large space is not required. Designated the No. 60, the unit is expected to be especially useful for fill caps and fill boxes. It has a 5-in. i.d. and a 6-in. depth. No wrench is required to lift the lid.

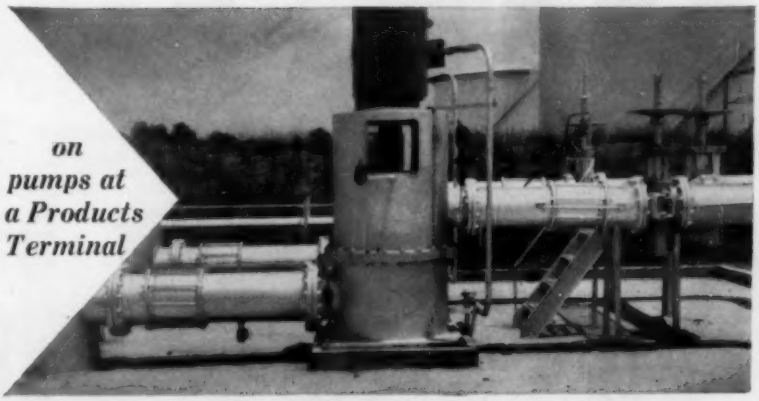
Both the lid and rim are constructed of cast iron with reinforced ribs. Construction of the manhole allows fill pipe to settle without creating strain on underground tanks. **Write or call: Universal Valve Co., 480 South Street, Elizabeth, N. J., for details on nonlocking manhole.**

Liquid-recovery unit for gas line

. . . dehydrates and strips natural gas without pressure drop or additives, the maker claims. The Chillgas field-process unit recovers liquid products from a natural-gas stream at line pressure. Negligible power and maintenance are required for the automatically controlled unit. It is skid-mounted for easy relocation or adaptation to new requirements.

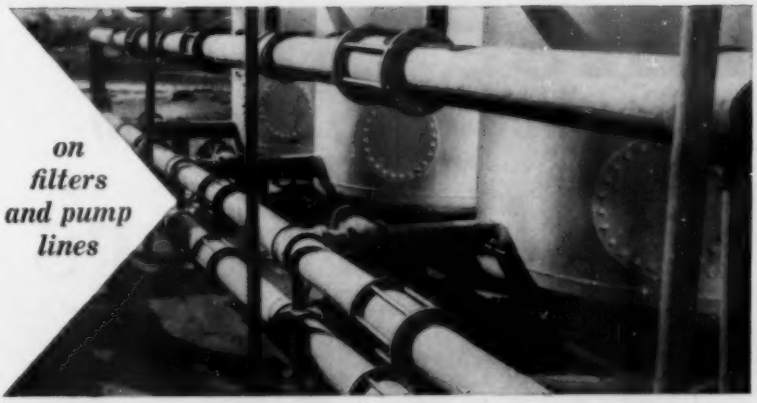
Add-a-Unit components are available. Capacity ranges from 500 to 25,000 M.c.f. per day, for pressures to 1,200 psig. Recoverable products, depending on equipment specified, include 12 or 14-lb. R.v.p. gasoline and LPG, to 1,000 bbl. per day. **Write or call: Chillgas Corp., P. O. Box 2536, Houston, for details on liquid-recovery unit.**

Dresser® Couplings—



on pumps at a Products Terminal

easy, bottle-tight...



on filters and pump lines

safe, permanent joints!

Dresser Couplings are easily installed and bottle-tight for life! The specially compounded Dresser Gasket provides rugged "give and take" to absorb vibration, settlement and other stresses that might cause damage. And there's no pipe threading. With plain end pipe, any workman can install Dresser Couplings in an average two man-minutes per bolt *using only a wrench.* And even with pipe deflection up to 4°, you still get a perfect Dresser-Coupled joint. Send for Dresser Catalog No. 531; it contains more detailed information and complete specifications on *all* Dresser Couplings, Fittings and Pipe Repair Products.

• GET THEM FROM YOUR LOCAL OIL FIELD SUPPLY STORE

Bradford, Pennsylvania
Chicago
Houston
Philadelphia
New York
S. San Francisco
Toronto & Calgary

DRESSER MANUFACTURING DIVISION

ONE OF THE DRESSER INDUSTRIES

NEW "Varec"

PULSE CODE
. . . telemetering System
For the remote reading of
P. D. Meters

HIGH SYSTEM CAPACITY — 99 identification numbers and 6 digits of data (one million counts — Barrels, Gallons — etc.).

ACCURATE to one point in one million for a 6 digit unit.

HIGH INPUT RATE — 18,000 counts per hour (max.).

FAST READ OUT time — only 7 seconds required to obtain a reading.

SLOW PULSE RATE of 5 per second — Does not require high grade telemetering channel — All parts operate well within ratings.

DIGITAL OUTPUT of receiver unit suitable for data logging or other data handling functions.

TRUE DIGITAL Pulse Code type of transmission.

"ERROR CHECKING" TYPE of code practically eliminates the introduction of errors by telemetering channel abnormalities.

TRANSMISSION (read out) may take place during change in measurement (P.D. meter can be running). The transmitter does not have to be "locked", nor is the use of other methods necessary to prevent ambiguous readings.

SYSTEM AND EQUIPMENT not limited to telemetering of single type of measurement — transmitters/convertors available for liquid level, temperature, pressure, etc. System arrangements available as accessory features for remote control functions, data logging and alarm signals.

RELIABLE — no vacuum tubes or other expendable parts are used; all components are rugged and used well within applicable ratings.

Request Bulletin CP-3701

961-29

"Varec"

The VAPOR RECOVERY SYSTEMS COMPANY
Compton, California, U.S.A.
Cable address: Varec Compton Calif (U.S.A.) All Codes

SHOWCASE . . .

New Literature

Udex process for solvent extraction

. . . of benzene, toluene, and xylenes from refinery streams or coke-oven light oil is summarized in a new booklet. Included are statistics on aromatics production trends, a flow sheet, and photos of equipment and instrumentation. Data on yields, estimated chemical and utility requirements, and operating-cost estimates are also included. **Write or call: Universal Oil Products Co., 30 Algonquin Road, Des Plaines, Ill., for booklet on solvent extraction.**

New liquid-level sensor

. . . called Betatrol—which employs a radioactive material in the sensing element is reviewed in new Technical Bulletin RF-581. Designed to provide an actuating signal to control or indicate a predetermined level, the unit employs beta radiation to furnish the benefits of nuclear research for more reliable and accurate industrial instrumentation. **Write or call: Robertshaw-Fulton Controls Co., 401 North Manchester, Anaheim, Calif., for Bulletin RF-581.**

Wire-rope service life

. . . can be extended by eliminating excessive localized wear and damage, according to new four-page Service Bulletin 106. The bulletin points out that users often discard lengths of otherwise usable rope because of localized damage. It lists possible causes of these conditions and suggests corrections that will extend service life. **Write or call: Leschen Wire Rope Div., H. K. Porter Co., Inc., 2727 Hamilton Avenue, St. Louis 12, for Service Bulletin 106.**

Hortonclad is a composite metal

. . . with the desired alloy or special metal integrally and continuously bonded to the backing plate by a combination of vacuum, pressure, and heat. As a solid corrosion-resistant material, it's described in a new 30-page bulletin. The special process and the metals that have been clad successfully are explained in the bulletin. **Write or call: Chicago Bridge & Iron Co., 332 South Michigan Avenue, Chicago 4, for Hortonclad bulletin.**

Special-hazard protection

. . . is covered in a comprehensive, easy-to-read 42-page booklet. Water

spray, foam, carbon dioxide, and dry chemical are the methods covered in the booklet. Fire-protection controls and devices are also thoroughly reviewed and illustrated. A handy selector chart helps you find your special hazard and the most commonly used extinguishing agents for the hazard cited. **Write or call: Grinnell Co., Inc., 260 West Exchange Street, Providence 1, R. I., for special-hazard fire-protection bulletin.**

New-equipment Catalog A-7

. . . features descriptions of spectacle blinds, spade blinds, spacer rings, temporary and line strainers, and pivot flanges. The eight-page bulletin details specifications and line drawings of the various styles of equipment offered. The equipment is designed for use in refining, petrochemical plants, and chemical processing. **Write or call: Mack Iron Works Co., 106 Warren Street, Sandusky, Ohio, for Catalog A-7.**

Transportable elevator

. . . for use in the petroleum and chemical industries is described in new eight-page Catalog 852-D. Said to be the only demountable personnel elevator meeting all safety regulations, it can be transferred from one job to another in less than a day. The car travels on a single vertical monorail. It can lift workmen or materials up to 250 ft. It is suitable for temporary or continuous service and requires no shaftway. **Write or call: Hawkeye Products Corp., 1013 South State Street, Syracuse 3, N. Y., for Catalog 852-D.**

Electrical-control equipment

. . . is described in a new 12-page catalog. Low-voltage switchgear, explosionproof equipment, high-voltage motor starters, motor control center, and specialized products such as oilfield motor starters, cathodic-protection equipment, and automatic pipeline samplers are described. A pictorial index is featured in the catalog. **Write or call: Nelson Electric Mfg. Co., P. O. Box 5385, Tulsa, for electrical-control equipment catalog.**

Use and care of wire rope

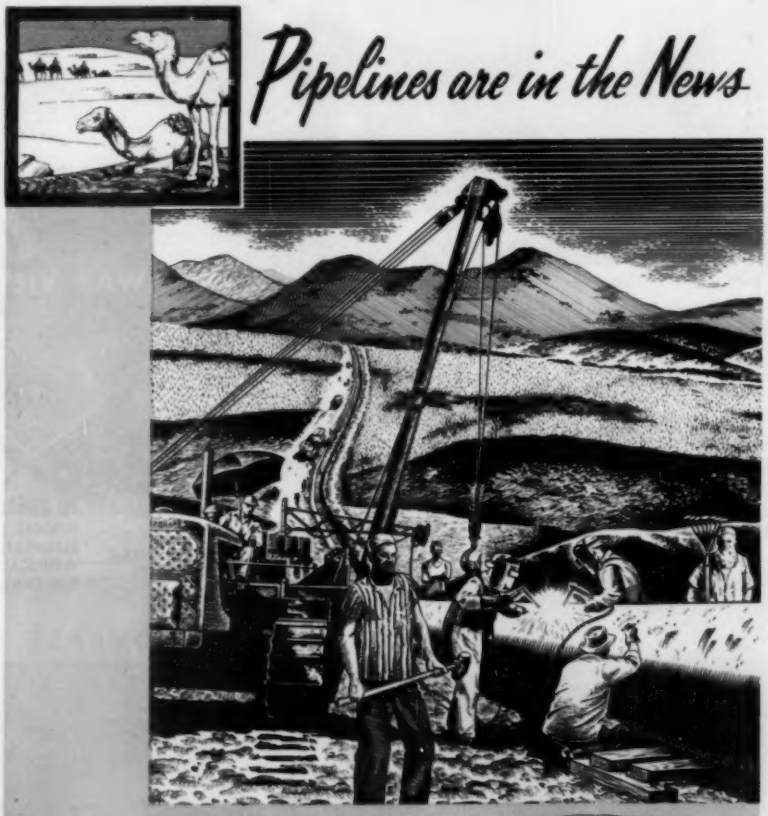
. . . is detailed in a new handbook. It's written for men who buy, sell, or use wire rope. The handbook contains 36-pages of up-to-date information, well illustrated, on points you need to know. It explains how to select the right rope for your specific needs; methods of socketing, splicing and installation, and important points on safety. **Write or call: Wire Rope Corporation of America, 609 North Second Street, St. Joseph, Mo., for Wire Rope handbook.**

Plastic-coated steel pipe

. . . called X-Tru-Coat is reviewed in new four-page Bulletin 770-R. The pipe and tubing is now yellow in color for high heat reflectivity. The folder describes the problems of pipeline corrosion, and shows how the strength of steel and the protection of plastic has been combined to meet the most severe corrosive applications. **Write or call: Republic Steel Corp., Advertising Div., Republic Building, Cleveland 1, for Bulletin 770-R.**

Truck and trailer size and weight

. . . restrictions are the subjects of a pocket-size booklet compiling the laws of all 48 states and the District of Columbia that regulate size and weight of trucks and trailers. The information in the handy booklet is classified by states. **Write or call: Four Wheel Drive Auto Co., Clintonville, Wisc., for truck and trailer size and weight-restrictions booklet.**



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CABLE ADDRESS: WILLBROS

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TAKE A CLOSE LOOK . . .

. . . AT A REAL CASING SEAL

The ***NEW***

WmSEAL "Z" BUSHING

FOR BIG-INCH PIPELINES IN STANDARD OR OVERSIZE CASINGS

NEW ELONGATED LIP
TWICE AS LONG . . . TWICE AS FLEXIBLE (See fig. 1 & 2)

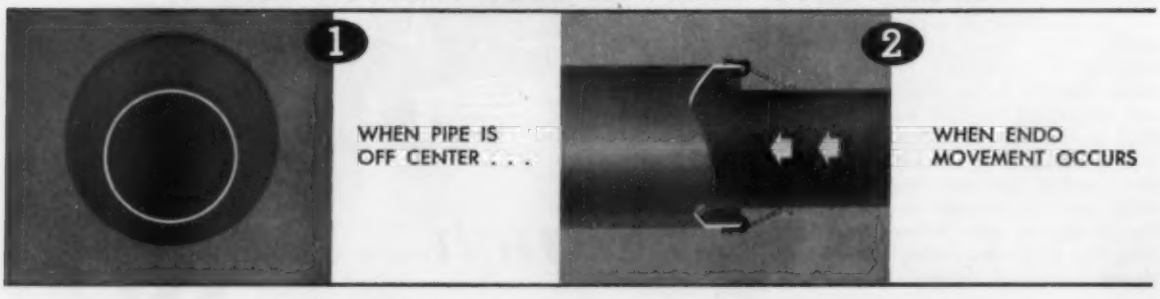
STAINLESS STEEL BAND, ANCHORED SECURELY BY S. S. CLAMPS

STAYS PUT ON CASING
NON-SKID TEETH AND EXTRA LONG GRIPPING AREA ANCHORS BUSHING SECURELY

PUNCTURE PROOF
EXTRA THICK SHOULDER (BUNA-S SYNTHETIC RUBBER) PREVENTS CASING EDGE FROM CUTTING THROUGH BUSHING

NO SHIELD REQUIRED
THICKER FLEXIBLE "LIP" ELIMINATES NEED FOR SHIELD. WITHSTANDS WEIGHT OF BACK-FILL EARTH

A TIGHT SEAL UNDER ADVERSE CONDITIONS



WHEN PIPE IS OFF CENTER . . .

WHEN ENDO MOVEMENT OCCURS

FOR PIPELINES IN SERVICE
IMPROVED WmSEAL SPLICED "Z" BUSHINGS ARE AVAILABLE

(Write for Literature)

T. D. Williamson, Inc.
P. O. BOX 4038 TULSA 9, OKLAHOMA

REPRESENTATIVES: HOUSTON • AMARILLO • PLAINFIELD, N. J. JOLIET, ILL. • JACKSON, MICH. • LOS ANGELES • SAN FRANCISCO BARTLESVILLE, OKLAHOMA • SEATTLE • SALT LAKE CITY • EDMONTON TORONTO • VANCOUVER • BUENOS AIRES • CABIMAS, ZULIA, VENEZUELA • DURBAN, NATAL, S. AFRICA • PARIS, FRANCE • SIDNEY, AUST.

Garrett Oil Tools, Ltd. opens

. . . in Edmonton, Alta. The new subsidiary of U. S. Industries, Inc., will sell and service the complete line of Garrett products. Guy A. Emslie will be manager of operations in Canada, headquartering in Edmonton. He was employed by Import Tool Co., formerly representing Garrett in Canada.

Jesse O. Sims appointed

. . . seismic supervisor of Robert H. Ray Co.'s new Four Corners area district office in Durango, Colo. Prior to his joining RHR in 1957, he was with Gulf Oil Corp. in various capacities. Previously to this new assignment, he was seismic supervisor in Pakistan and Houston.

L. G. Johnson named manager

L. G. Johnson

. . . of the Oklahoma City branch office of Nelson Electric Manufacturing Co., reports H. A. Norberg, president. Johnson will supervise sales and service of the firm's electrical control equipment and products in western and southern Oklahoma and Texas Panhandle. He formerly was assistant service engineer. During the past year he has conducted safety demonstrations of cast iron enclosures.

Oil Well Supply Division shifts

. . . Carlton J. Roper, field representative at Ellinwood, Kans., to El Dorado, Kans., according to Mark Barkhurst, Mid-Continent area manager of the division of U. S. Steel Corp. Roper joined Oilwell in 1952 at Wewoka, Okla., and became field representative there in 1952. He transferred to Ellinwood in 1957.

PGAC extends its services

. . . of induction-electrical, electrical logging, Laterolog, and Micro-Laterlog to the West Texas area with headquarters in Odessa. George Decker transfers to Perforating Guns Atlas Corp.'s Lafayette, La., office as district manager of the South Louisiana district.

Harry B. Hacke returns to the Houston plant and resumes his former duties as operations superintendent and assistant to James H. Russell, manager of operations. Robert D. Tibbs moves up to district manager of the Oklahoma district, headquartering at Oklahoma City.

Robert E. Dunn appointed

R. E. Dunn

. . . merchandising manager for Cardwell Manufacturing Co., reports Clyde M. Lackey, domestic sales manager. Dunn will headquarter at Wichita. He will be responsible for contact with the field and the supply stores to improve services and supervise stock control for customer needs. Before joining Cardwell, he had 14 years' experience with Mid-Continent Supply Co.

Bucyrus-Erie names distributors

. . . in Michigan and part of Pennsylvania, to sell oil and water well drills. Utility & Industrial Supply, Jackson and Mount Pleasant, Mich., will represent Bucyrus-Erie Co. in Michigan's lower peninsula except for counties south of and including Van Buren, Kalamazoo, Calhoun, Hillsdale, Lanawee, and Monroe.

Chandler-Boyd Co., Leetsdale, Pa., will be distributor in Pennsylvania counties south of and including Erie, Crawford, Venango, Clarion, Jefferson, Clearfield, Centre, Blair, and Bedford.

New Los Angeles Nomads

. . . inducted at the June meeting are shown standing between Earle Atkins, Devex Engineering Co., and F. J. Olson, Southwestern Engineering Co. They are: C. W. Zublin, Sales and Engineering Associates; J. V. Pennington, Globe Oil Tools Co.; and W. L. Brannon, Hydril Co.

Personnel changes announced

. . . by Houston Oil Field Material Co., Inc. Jack Brothers, office manager, Billings, Mont., moves to Kimball, Neb. W. H. Dodson, Jr., field salesman, Bay City, Tex., becomes assistant store manager, Beaumont, Tex. Robert E. Duke shifts from executive assistant of directional

Incoming board of directors take office

. . . at the first scheduled meeting of Natural Gasoline Supply Men's Association in Dallas, Tex. Members are, seated: C. P. Stanley, Dresser Engineering Co.; Rudy Zorn, Cameron Iron Works; W. F. Hildebrand, General Electric Co.; W. F. Matheny, Arrow Industrial Manufacturing Co.; incoming President H. O. Sears, Alliger & Sears Co.; G. C. Thrift, Koch Engineering Co.; retiring President Jimmy Dvoracek, Nordstrom Valve Division, Rockwell Manufacturing Co.; E. L. Stark, The Foxboro Co.; A. F. Canada, Pacific Pumps, Inc.; R. P. Walker, Minneapolis-Honeywell Regulator Co.; and Jimmy Okeson, Refinery Supply Co.

Standing are: C. Victor Bolles, Davison Chemical Co.; F. W. Bell, Brown & Root, Inc.; J. B. Zachry, Worthington Corp.; James S. Kone, James S. Kone Co.; Ray F. Riddle, Riddle & Hubbell Co.; T. R. Cross, Paramount Supply Co.; E. O. Haltom, Trinity Steel Co., Inc.; James E. Hughes, Western Supply Co.; and I. Earl Nutter, Nutter Engineering Co.

drilling to executive assistant of marketing. L. M. Ebeling goes from fishing tool supervisor, New Iberia, La., to district manager, Pampa, Tex. Robert Morgan shifts from Farmington, N. M., to fishing tool supervisor, Casper, Wyo. Charles H. Pollard transfers from Lafayette, La., to manufactured products, Houston. Robert Thomason switches from Kimball to Casper as field salesman.

A. S. Berry authors book

. . . titled "How to Make Money in Oil." Berry is a Tulsa based oil investments dealer. The book will discuss leasing, royalties, a summary of oil law, and information on producing and probable producing areas. The volume will be ready for delivery in late August or early September.

Tretolite Co. reports changes

. . . in its staff of field service engineers of the division of Petrolite Corp.

W. L. Brown, field service engineer at El Dorado, Kans., transfers to Anaco, Venezuela. He has been replaced by Troy Driver. L. L. Trompke becomes field service engineer at Kimball, Neb., and N. J. Ruder is assigned to Plainville, Kans. J. H. Turner goes to New Iberia, La., and L. L. Slade to Odessa, Tex.

McCullough Tool Co. assigns

. . . Adrain Fitzsimmons as manager of its Sterling, Colo., branch, according to I. J. McCullough, president. Harmon P. Burns, former manager, transfers to the Farmington, N. M., branch in the same position. Fitzsimmons has been with McCullough for over 4 years, most recently as a service unit operator in the Casper, Wyo., branch.

Adrain Fitzsimmons

Fluid Packed Pump Co. promotes

. . . three in the sales department, reports Don Vandenburg, sales manager. Bill G. Reeves moves to eastern Venezuela as sales representative. Jack Clements transfers to Denver, Colo., as manager of the northwest division. Vaughan Holton shifts to Calgary, Alta., as manager of the Canadian division.

Vaughan Holton

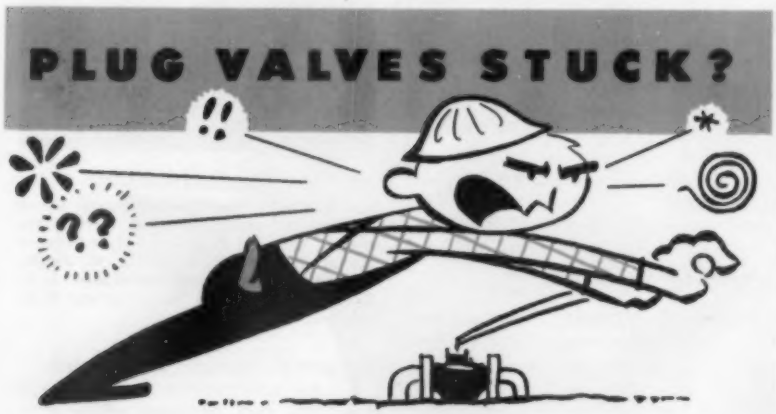
B. G. Reeves

Jack Clements

E. A. Dunn heads new division

. . . created when one Continental-Emsco Co. division was divided to make separate ones, according to F. I. Brinegar, executive vice president, distribution. The South Louisiana division with Dunn managing, will headquarter in New Orleans. The South Texas division, with headquarters in Houston, will remain under the management of R. A. Gentry. R. L. Cavnar is promoted to district manager, Houston district. Both new divisions are under supervision of R. Hortenstine, Jr., vice president.

E. A. Dunn



cussin' won't help—but DESCO Lubricants will!

Because DESCO Synthetic Lubricants are ALL lubricant, and contain NO inert material, they will not harden and coke-up in your valves. And no matter what the fluid or its temperature, DESCO Lubricants are designed TO STAY in your valves. Keep valves operating smooth and easy. Eliminate costly valve damage and dangerous leaks.

ONLY 4 STANDARD AND 3 REGULAR Desco Lubricants handle ALL valve services, and most plants require only one or two. Reduce the chance of using the wrong lubricant. Eliminate large warehouse stocks. Specify DESCO.

STICKS OR BULK. Packed in clean, convenient sticks in 5 sizes for gun or jack screw, and in 5-qt., 40-lb. and 100-lb. containers.

Lubricate 'em AUTOMATICALLY

A valve will last longer and operate better when equipped with a DELTA Automatic LUBRICATOR. This simple, low-cost device lubricates the valve each time it is opened and closed. Pays for itself in no time.

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WRITE FOR CATALOG
The Only Complete Plug Valve Lubrication Company

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Color Coded Lubricants • Hand Guns
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HALLIBURTON'S
VR SAFETY JOINT
with Built-in By-Pass
for "PRESSURE EQUALIZATION"

Used immediately above the packer in either open hole or casing testing, the Halliburton VR Safety Joint helps to insure faster and safer reservoir evaluation.

Although its primary function is to assist in the removal of drill pipe and major portion of testing tools in case of stuck anchor or packer, the unique design of the VR Safety Joint provides another highly important feature. A large area By-Pass incorporated in the Safety Joint, located immediately above the Packer, where by-passing is most effective, provides immediate equalization of pressure through the packer at the completion of the test. This is extremely important in helping to prevent sticking of packer.

It also serves as an auxiliary to the By-Pass in the Hydro-Spring Tester to aid in running in the hole.

IMPORTANT BENEFITS OF THE VR SAFETY JOINT INCLUDE:

★ Drill pipe and testing tools might be quickly and safely retrieved when either packer or anchor becomes stuck.

★ The VR Safety Joint helps to prevent major loss of tools. The right-hand rotation used to release the Safety Joint's left-hand thread will not back off a tool joint.

★ When back-off is necessary, a simple combination of right-hand rotation and vertical movement of drill pipe allows the thread to be unscrewed easily and testing tools are removed from the well.

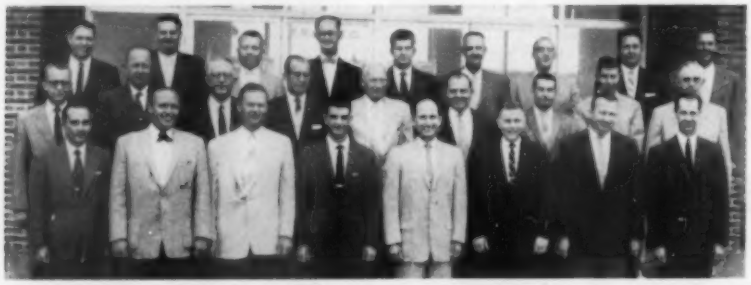
Get these advantages for your next formation test. Specify Halliburton Testing Service . . . *for testing results you can trust* . . . and be sure to include the benefits of the VR Safety Joint in your testing string. Available in 5", 3⅞" and 3" O.D. sizes.

HALLIBURTON TESTING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY, DUNCAN, OKLAHOMA

Texsteam Corp. personnel holds sales meeting

. . . at Galveston, Tex., conducted by Frank Richards, sales manager. Attending the meeting were, front row: Paulo Neves, C. W. Miller, Ed Noble, Jay Hauteman, Fred Russell, Arnold Houson, Roland Rix, and Sid Covington. In the second row are: William Colvin, T. R. Rhodes, Dick Albrittian, E. E. Rhodes, D. W. Miller, Jim Gravitt, Ralph Mullikin, Curt Pearson, and Ray Wolfe. In the back row are: Platt Turner, L. V. Musgrove, C. W. Fager, Dick Cunningham, Hank Wrigley, F. O. Richards, Saul Bellilove, William King, and William Lee.



Strom Steel Ball Co. transfers

. . . its entire executive offices and plant facilities from Cicero, Ill., to a new plant in Erwin, Tenn., reports Robert Strom, president. The company engages in the manufacture of high precision metal balls for the petroleum, machinery, and other manufacturing industries.

W. H. Mouquin named manager

. . . of the New York district office of De Laval Steam Turbine Co. The new office will provide direct sales and service facilities for De Laval products formerly handled by Turbine Equipment Co. of New York. Mouquin joined De Laval in 1955 as manager of the Chicago district office.

J&L Supply makes major changes

. . . in its sales districts and organization, according to W. L. Wolfe, vice president of sales. Headquarters of the North Rocky Mountain district moved from Billings, Mont., to Williston, N. D. The Central Rocky Mountain district will now include stores at Worland and Powell, Wyo., both formerly in the North Rocky Mountain district. The North La.-Ark.-Miss. district with headquarters at Shreveport is divided to make a new Mississippi district with headquarters at Laurel. The new district will include stores at Laurel, Brookhaven, and Natchez.

G. E. Best

M. A. Park

G. E. Best becomes district sales manager of the North La.-Ark. district, filling a vacancy created by the death of J. A. Evans, Jr. M. A. Park will be district sales manager for the Central Rocky Mountain district at Casper.

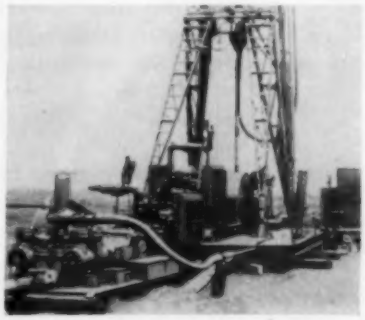
C. H. Kellogg is promoted to district sales manager for the North Rocky Mountain district. L. W. Todd is promoted to district sales manager for the Mississippi district, and G. R. Gardner is shifted as salesman to Morgan City, La.

C. H. Kellogg

L. W. Todd

GSI continues student plan

. . . under which qualified college students are given an opportunity to gain actual field experience in geophysical exploration for oil. To date, the program, sponsored by Geophysical Service, Inc., Dallas, has given field training to 142 students from 42 colleges and universities. In June 18 more students started the 4-day orientation course preceding the summer of field work. Subjects range from fundamentals of geophysics to philosophy of seismic instrumentation and definition of gravity anomalies.



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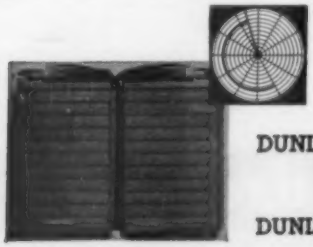
. . . over 7 years of continuous service. Operated by Rex & Morris Drilling Co., near El Dorado, Kans., this National T-25 has averaged 8½ days per 3,000 ft. of hole. The crew sets up in 3 to 4 hours and dismantles and loads in 2½ to 3 hours. The rig has drilled 297 wells for a total of 893,258 ft. of hole in 82 months.



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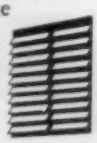

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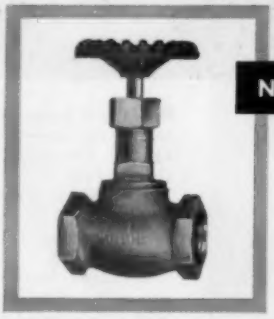

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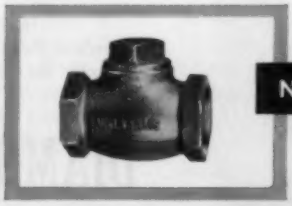

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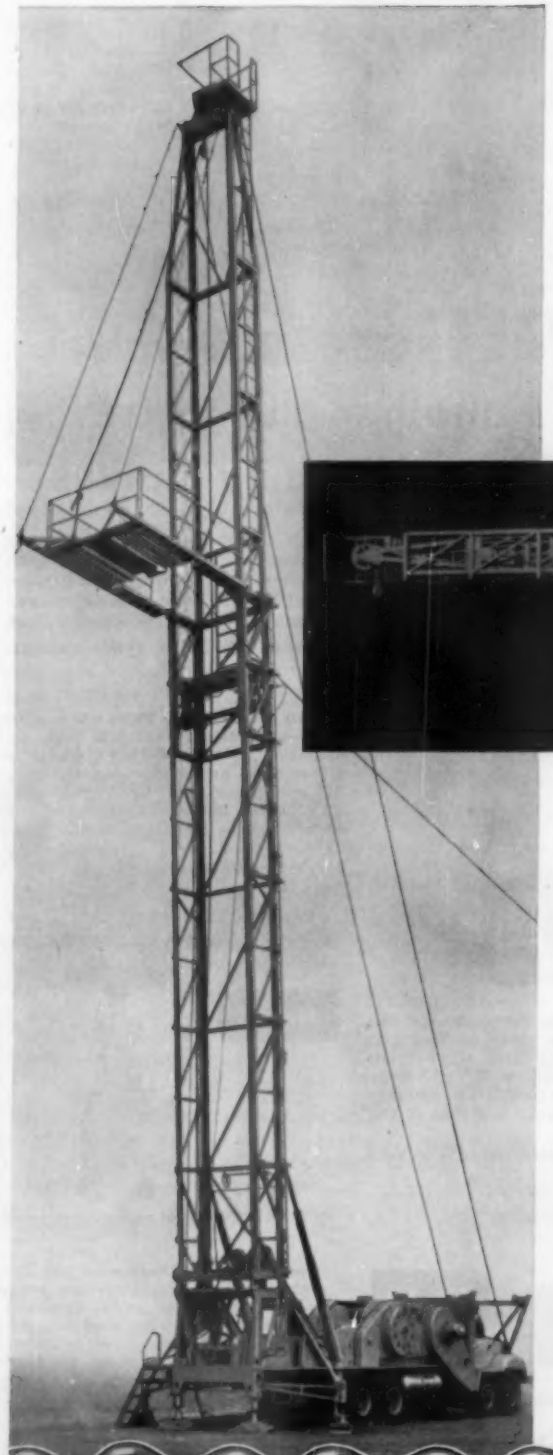

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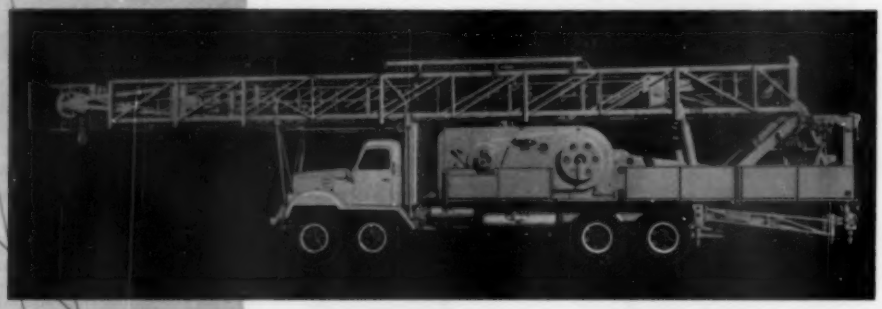

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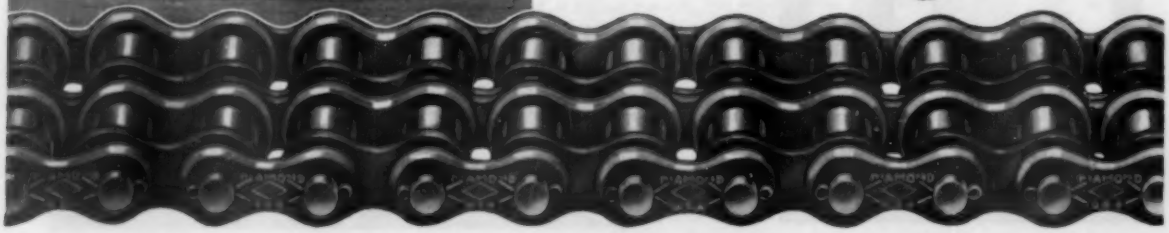

Berland River—deep, thick, and big

It's Alberta's brightest star in a star-studded firmament

BY FRANK J. GARDNER

WESTERN CANADA rang the bell again last week with another exploration superlative. It's been a year of superlatives for Canada, if not a superlative year. The first this and the first that, the deepest this and the biggest that. Now comes the thickest reef. And the deepest production.

A superlative strike . . . In western Alberta, at the Berland River A-8 wildcat, on LSD 8, 4-59-23w5, British American Oil Co., Ltd., and Shell Oil Co. of Canada, Ltd., sliced through 663 gross feet of Leduc-Devonian D-3 reef to set a new record for this kind of find. Rumor has it that water was finally found at bottom depth of 12,677 ft. Reef top was at 12,014 ft. How much of this will emerge as net pay is of course not yet determined, but another major gas field is certainly on the map. On drill-stem tests of the 12,016-12,183-ft. interval, gas flows up to 27,000 M.c.f. per day was posted. Operators are now completing the discovery at this level. The two companies hold a 400,000-acre reservation surrounding the strike.

Not only is this the thickest reef yet found, but it's also the deepest. Deepest productive, that is; earlier, the Pan American Petroleum Corp. 10-10 Berland River, about 13 miles southwest of the new success, had found the same D-3 reef at 13,000 ft. and below, but it was waterladen at that depth. At 12,014-12,235 ft., the Berland River well is not only the deepest **reef** production in Canada, but the deepest production of **any** kind. Commercial D-1 gas flows were found earlier at 13,000 ft. in Canada's deepest hole, the C.F.A. group 6-4 Lambert Creek (total depth 15,195 ft.), but that wildcat finally was plugged.

Is the biggest this year . . . So it's the thickest and the deepest. What else? Well, some say it's the "biggest." Biggest what? Here we get lost in a fog of generalization. To be the biggest by way of initial potential, the discovery must reach into nine figures of cubic feet; this statistic is not yet known. To be the biggest field, Berland River must develop reserves in excess of 1.7 trillion cubic feet. The words "reef," "Leduc," and "D-3" have a magic effect on the minds of oil people, and the finding of 663 solid feet of all three at once is enough to set off storms of speculation. Let's just say it's the biggest thing to hit Canada this year and let it go at that.

DISCOVERY of Devonian D-3 gas production at Berland River has broken several Canadian records. In the string of gas fields shown here is an estimated gas reserve of 6.7 trillion cubic feet. Most of these are in the foothills belt. Now a new discovery theater opens to the north, to further enhance the Canadian gas-reserve picture.

So much for superlatives. How does the new discovery compare with other D-3 pay sections? In the "Leduc Trend" of fields surrounding Edmonton, the average pay thicknesses range from 15 ft. at North Bonnie Glen to a maximum of 520 ft. at South Golden Spike; these are net thicknesses and are, of course, oil reservoirs. In the Sturgeon Lake area, 60 miles due north of Berland River, the average pay section is 117 ft., again an oil zone.

Most Leduc gas is associated gas. If B.A. and Shell should develop a major gas field at Berland River, it would be the first such development for Alberta. Here may lie yet another superlative. But if later drilling should reveal an oil deposit, the strike would take on entirely new significance. And this is conceivable.

So keep your eye on an entirely new target area in central west Alberta—Berland River may deliver even more superlatives in the next few months.

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Early climates: clues to source rocks

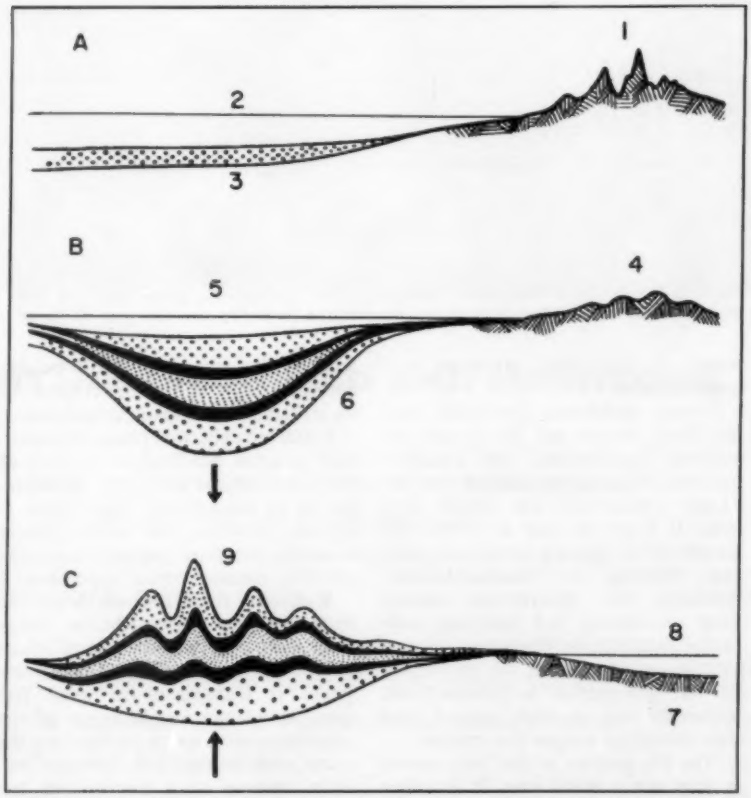
BY BARTHOLOMEW NAGY
Fordham University

AFTER the surface temperature of the earth had sufficiently decreased, the crust crystallized out and differentiated into components. The land mass was built up of a layer composed chiefly of aluminum silicate compounds, which was underlain by a layer of mainly iron-magnesium silicates. This latter basaltic-type layer was also found to be present under the oceans. The land masses may be visualized to be floating on a denser substratum, just as a piece of wood floats on water.

During geologic history there were various periods of intense mountain-building activity (orogenesis) when deformation of the crust was more intense than at other times. Such periods produced some of the great mountain chains, such as the Alps, Appalachians and the Rocky Mountains. These periods of orogenesis can be fairly well located within the geological time scale, and they can be assigned specific names. For example, the mountain building in the northern part of the Appalachian Mountains formed a part of the so-called Acadian Revolution. This took place during the Devonian period approximately 300 to 400 million years ago.

As soon as the newly formed mountain ranges were erected, the atmosphere and the hydrosphere started trying to reduce these peaks. Wind action, repeated freezing and thawing, and dissolution of the minerals in water began to take place. In other words, erosion started. The sediments (the eroded rock debris) were carried down by streams and rivers to the seas.

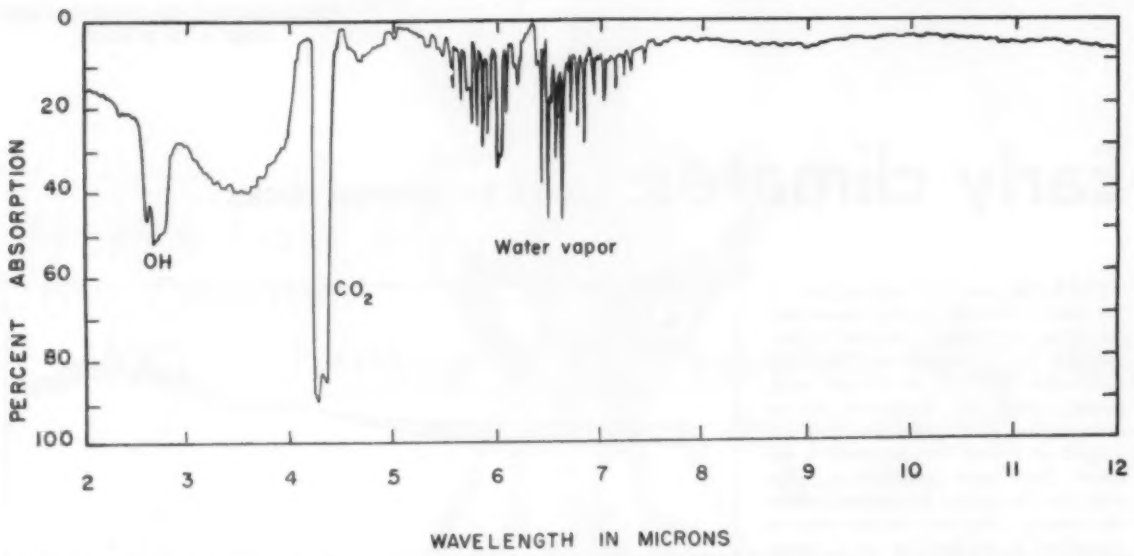
The crystalline rocks were composed mainly of feldspars (sodium-potassium silicates), quartz (silicia), micas (metal-hydrous silicates), and iron-magnesium silicate minerals. Depending on whether it was the intense mountain-building period or a subsequent period of quiescence, (when the mountains were already worn down to their roots), the action of the elements differed. During the period when deformation was the most intense, when the youthful mountain peaks were the highest, rapid torrents of mountain streams broke up the crystalline rock and carried down the fragments to nearby sedimentary basins without the chance of much chemical alteration. Generally, most of the sedimentary rocks formed during this period are called arkoses.



SCHEMATIC OUTLINE of the geosynclinal cycle. A. The mountain range (1) is eroded and the sediments are carried to the sea (2), where they are deposited (3). B. Erosion has worn down the mountain range (4) and the sediments carried to the sea (5) form a thick deposit (6) in a sinking valley. C. Orogenesis has uplifted and folded the sediments of the geosyncline (9) which are, in turn, eroded, carried to the sea (8) and deposited on the rocks (7) that were worn down by erosion in B. Fig. 1.

On the other hand, the prolonged action of the atmosphere on denuded plains effected a slow chemical dissolution or alteration of all but the most stable minerals (quartz in such a stable mineral). These quartz particles were subsequently carried away by long and slow river transport to distant sedimentary basins. There they formed the rocks which are called quartzites. In between these two extremes of sedimentary rock types are the graywackes which are the most common sedimentary rocks in the Mid-Continent.

Most of the sedimentary matter received by the sea was deposited along the shore lines, which became sinking troughs or geosynclines. As time passed, more and more sediments were deposited in the geosyncline; the sediments which were received first were buried deep by the subsequent arrivals and thus were ex-



PART of the infrared absorption spectra of the atmospheric gases resolved with NaCl optics. The air sample was collected on ground level in New York City. Its relative humidity content was 52% at room temperature. Fig. 2.

posed to increasing pressures and temperatures.

It was mentioned previously that the land masses are in a state of physical equilibrium, the so-called isostatic balance, in respect to the denser substratum on which they float. It is not possible to reduce the weight of the floating land mass without affecting its "sea-worthiness." Similarly, the geosynclines cannot keep on sinking and receiving sediments indefinitely. Therefore, after a certain period of time the movement of the geosyncline is reversed, the sediments are pushed upward and new mountain ranges are erected.

The life process of the land masses is thus not a static one. It is rather a sequence of cycles and pulsations; geosynclines are elevated to form new mountain chains, which in turn, are eroded to give rise to new geosynclines. Fig. 1 is a schematic illustration of the geosyncline cycle.

After such a rudimentary outline of modern sedimentary geology, drawn in part along lines proposed by Krynine (1948), one may examine more closely the role of the atmosphere because this is the agent which plays a decisive role in the chemical and physical erosion and in the accumulation of sediments. Is there perhaps a connection between periods of intense mountain building and weather conditions?

The presence of carbon compounds in the primitive atmosphere, carbon dioxide, carbon monoxide and methane, has already been shown to be significant in respect to chemical evolution in the earliest geological times. Again the carbon dioxide content of the atmosphere will be examined; this time with respect to its influence on climatic conditions.

Unfortunately, this phase of knowledge is again handicapped by lack of sufficient critical data and, therefore, has to be treated with reservation. It appears, however, that certain recent scientific findings support the now-old CO_2 climate-control hypothesis.

Radiation from the sun heats the surface of the earth, whereas radiation from the earth toward space causes surface cooling. The atmosphere is transparent to most frequencies of the visible range of the electromagnetic spectrum reaching the earth from the sun; it is, however, partially opaque to a number of frequencies in the infrared range of the spectrum.

Because of the relatively low temperature prevalent on the earth's surface and in the atmosphere, most of the outgoing radiation falls within the infrared range. Because the atmosphere is in part opaque to infrared, the terrestial radiation has difficulty in leaving the earth; consequently, the temperature on the earth's surface is higher than it would be if the atmosphere were entirely transparent to the infrared radiation.

The three most abundant gases in the postprimitive atmosphere were nitrogen, oxygen, and argon. However, none of these gases absorp appreciably in the infrared range of the spectrum. On the other hand, carbon dioxide, water vapor, and ozone, all present only in minute quantities, do absorb strongly within the infrared spectrum.

The concentration of carbon dioxide in the atmosphere is only approximately 0.03% by volume, but it is fairly uniformly distributed in the atmosphere as far as high-altitude measurements can tell. The distribution of water vapor and ozone does not seem to be uniform; rather, it varies with time and place.

The carbon dioxide theory of climate control was first proposed by Tyndall (1861); however, following repeated criticism it was temporarily discarded in favor of other climate-control theories. Recently accumulated evidence, based on detailed infrared spectroscopic measurements, appear to reestablish the possibility of the carbon dioxide theory. Plass (1956) reasons that the carbon dioxide absorption lines in the infrared spectrum are independent and often do not overlap the water-vapor absorption lines. Furthermore, he claims that the water-vapor concentration is limited only to the lower portion of the atmosphere and that H_2O content decreases rapidly at higher altitudes, leaving the carbon dioxide molecules as virtually the sole infrared absorbers.

This is the argument offered to counter the contention that the absorptive properties of atmospheric water vapor cancel out any effect which CO_2 might have in preventing terrestial heat radiation to dissipate into space.

Another criticism of the carbon dioxide theory is that the atmosphere is already opaque at the spectral range where the strongest CO_2 infrared absorption band is located. However, numerous CO_2 absorption lines are present outside this interval.

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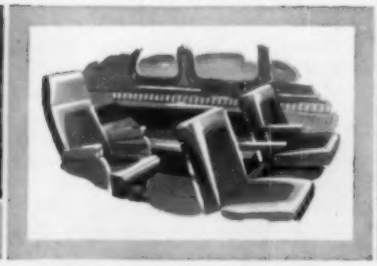

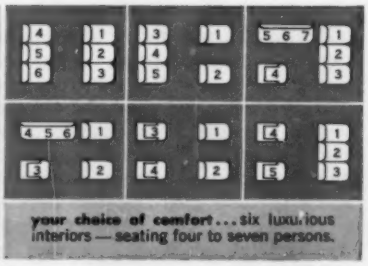

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Arnulf, Bricard, Cure and Veret (1957) studied the transmission properties of hazes and fogs and presented infrared spectra of the atmospheric gas constituents. Although these spectra are poorly resolved they too indicate the possibility of the significance of CO_2 absorption.

The reader may assess part of the spectroscopic evidence by examining the spectra of air (including water vapor and CO_2) shown in Fig. 2. These spectra were obtained at Fordham University. It is important to note that the absorption intensities will change when the pressure is reduced.

When the concentration of carbon dioxide in the atmosphere is raised, the absorptive properties of the atmosphere increase, less heat is allowed to escape toward space and, consequently, the climate gets to be warmer. Similarly, a decrease of atmospheric CO_2 content leads to a colder climate. One may be surprised to find that such an effect could be noticeable at all because the atmospheric CO_2 concentration is quite low. However, calculations show that a change of only a few degrees in the average terrestial temperatures will produce noticeable climatic effects.

A rise of only approximately 4° C. in the average temperature would bring tropical climate to most of the earth's surface and a decrease of approximately 7° C. in average temperatures would bring back the glaciers of the Ice Age. Such relatively minor changes in the average temperatures can be accounted for by the addition or subtraction of realistic amounts of CO_2 from the atmosphere.

The latest figures available show that the atmosphere contains approximately 2.3×10^{12} tons of CO_2 and the oceans contain 130×10^{12} tons of CO_2 and carbonates; the carbon dioxide pressure is approximately 3×10^{-4} atm. The atmosphere-ocean system attempts to maintain equilibrium. If the CO_2 content of the atmosphere changes carbon dioxide is added or subtracted from the oceans.

There is a factor, however, which tries to hold back this attempt to reach equilibrium. Radiocarbon dating of deep ocean waters by Kulp (1952) has shown that there is little circulation between the surface and the deep waters. This means that it may take tens of thousands of years for the oceans to reestablish equilibrium with the atmosphere; during this nonequilibrium period the changed atmospheric CO_2 content has ample time to cause changes in the climate.

If the carbon dioxide content of the atmosphere were appreciably reduced, perhaps by as much as 30% or more, a permanent glaciation would ensue. Decreases of lesser magnitude can be counteracted by the oceans—in due time. During the nonequilibrium period, however, temporary glaciations will take place. This is how the carbon dioxide-climate theory accounts for the various glaciations in geologic history.

The significant aspect from the sedimentation point of view is that periods of intense mountain building disturb the atmospheric-ocean CO_2 equilibrium. After the geosyncline is uplifted and the sediments undergo folding, and the new mountain range is first erected (a period which is also characterized by intense volcanic activity), large amounts of igneous and sedimentary rocks are suddenly exposed to erosion.

This results in the formation of carbonate weathering products, and thus leads to the removal of CO_2 from the atmosphere. Increased volcanic activity, however, adds CO_2 to the atmosphere. Depending on which of these two opposing factors is more pronounced, the atmospheric CO_2 content is either reduced, stays at its current level, or is increased.

If the CO_2 content is reduced, the mountain-building activity will be followed by glaciations. There seems to be geological evidence indicating that glaciations followed extensive mountain-building periods in the geological past.

The climatic change, produced by the disturbed atmosphere-ocean CO_2 equilibrium, appears to involve a series of oscillations between cold and warmer climates. It also appears to affect the average precipitation. Combinations of climatic oscillations and varying patterns of precipitation can produce a variety of climatic conditions. This leads to some interesting speculations. Because the weathering of rocks and, consequently, the development of the new sediment types depend greatly on climatic conditions, one may add another controlling factor to sediment genesis beside mountain building (orogenesis). This factor is the orogenesis-induced climatic control. Future research will decide whether it is possible to predict the ensuing climate from the manner in which the orogenesis proceeded.

The atmosphere-ocean carbon dioxide balance seems to have an effect on the development of organic mineral deposits. Coal is formed from plant matter and it is assumed that petroleum and natural gas, too, have evolved from plant and/or animal life. These organic mineral deposits incorporate a large amount of carbon which had to be withdrawn, at one time, from the atmosphere-ocean system. Favorable climatic conditions and the abundance of carbon dioxide in the atmosphere for photosynthesis have a stimulative effect on plant and, consequently, animal life.

It is possible, therefore, that orogenesis and the related climatic conditions together with other possible causes can produce an environment which is most favorable for plant and animal life. Such an increased activity in metabolic processes necessitates the withdrawal of increased amounts of CO_2 from the atmosphere.

In a steady state the same amount of carbon dioxide is returned to the atmosphere by all the processes of respiration and decay of plants and animals. If, however, the carbon dioxide is prevented from returning to the atmosphere, for example by the burial of plant and animal debris in the sediments, the atmospheric CO_2 content will be reduced, and consequently the climate will become colder. It may be interesting to note that the glaciation which followed the Carboniferous might have been the most severe in the earth's history.

Modern analytical techniques are capable of detecting relatively minor climatic variations in sedimentary rocks. X-ray diffraction and various spectroscopic methods, thermodynamic calculations, results of recent phase-equilibria studies of sedimentary mineral systems, etc., are the aids in such an undertaking.

X-ray diffraction studies of the crystallinity of clay minerals in rocks can lead to an evaluation of the climatic conditions and physical chemical environment prevalent during sedimentation. In a recent paper Keller (1956) summarized the available information on clay-mineral indicators. The environment of clay-mineral formation may be described as a "chemical microclimate" in respect to ionic concentrations, redox potentials and the temperatures of the various geological systems.

NOTE: Parts 3, 4, and 5 will run biweekly in future issues of The Oil and Gas Journal. In Part 1 of this series, which appeared June 30, 1958, the following correction should be noted: On page 127, second paragraph, dealing with primitive envelopes suggested by various authors for the planet earth, Bernal (1951) was shown as giving the Hydrosphere content as: "CO_2, NH_3, N_2S, H_2O." This should read: "CO_2, NH_3, H_2S, H_2O."

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The results of this are expressed in variations in the atomic structures of the minute clay crystals detectable by X-ray diffraction analysis. A physical-chemical environment characterized by the availability of H^+ ions for an attack on the crystallites, together with the presence of Na^+ and K^+ ions in the leaching solutions and redox potentials effecting $Fe^{++} - e \rightarrow Fe^{+++}$ reactions, is usually considered conducive to kaolinite synthesis in nature.

A climate where precipitation exceeds evaporation and a topography lacking stagnant bodies of water, can produce such a physical-chemical environment. Clay minerals, however, are not the only indicators of paleoclimate. Krynine (1949) found that most detrital red beds were formed under warm and **moist** (such as tropical savanna type) climatic conditions (mean annual temperature above 60° F. and annual rainfall over 40 in.).

Certain red beds can be useful indicators because various red beds are frequent constituents of the geological column. For example, parts of the Permian of West Texas, the Pennsylvanian Fountain formation of Colorado, the Devonian Catskill of the Appalachian region, etc.

It may be possible to prospect for petroleum source rocks (or even for hydrocarbon deposits, if one is willing to assume that the reservoir fluids did not migrate far from their source) by tracing climatic variations in a given geological column. Based on the CO_2 climate-control theory, it is conceivable that petroleum source rocks could be found more likely among rocks which were deposited shortly before the onset of a cold and wet climate (or more likely before a series of oscillations between cold wet and warmer climates began).

In Canada's Northwest Territories

Shell pioneers summer drilling

THIS YEAR, for the first time, Shell Oil Co. of Canada, Ltd., is attempting a deep test in the Northwest Territories during the summer season.

Drilling in the Territories is normally scheduled as part of a winter program because of the difficulties in transporting materials across that area during the warmer seasons. The site chosen for this operation is in the remote Liard River region, some 650 miles north-northwest of Edmonton in the southern part of the Territories.

Although the new drilling program does not hinge specifically with the recent land rush in the region, it is quite significant in that it is the first deep test in this area. The closest basement drilling occurred some years ago in the Norman Wells region some 350 miles north-northwest of the recently staked site.

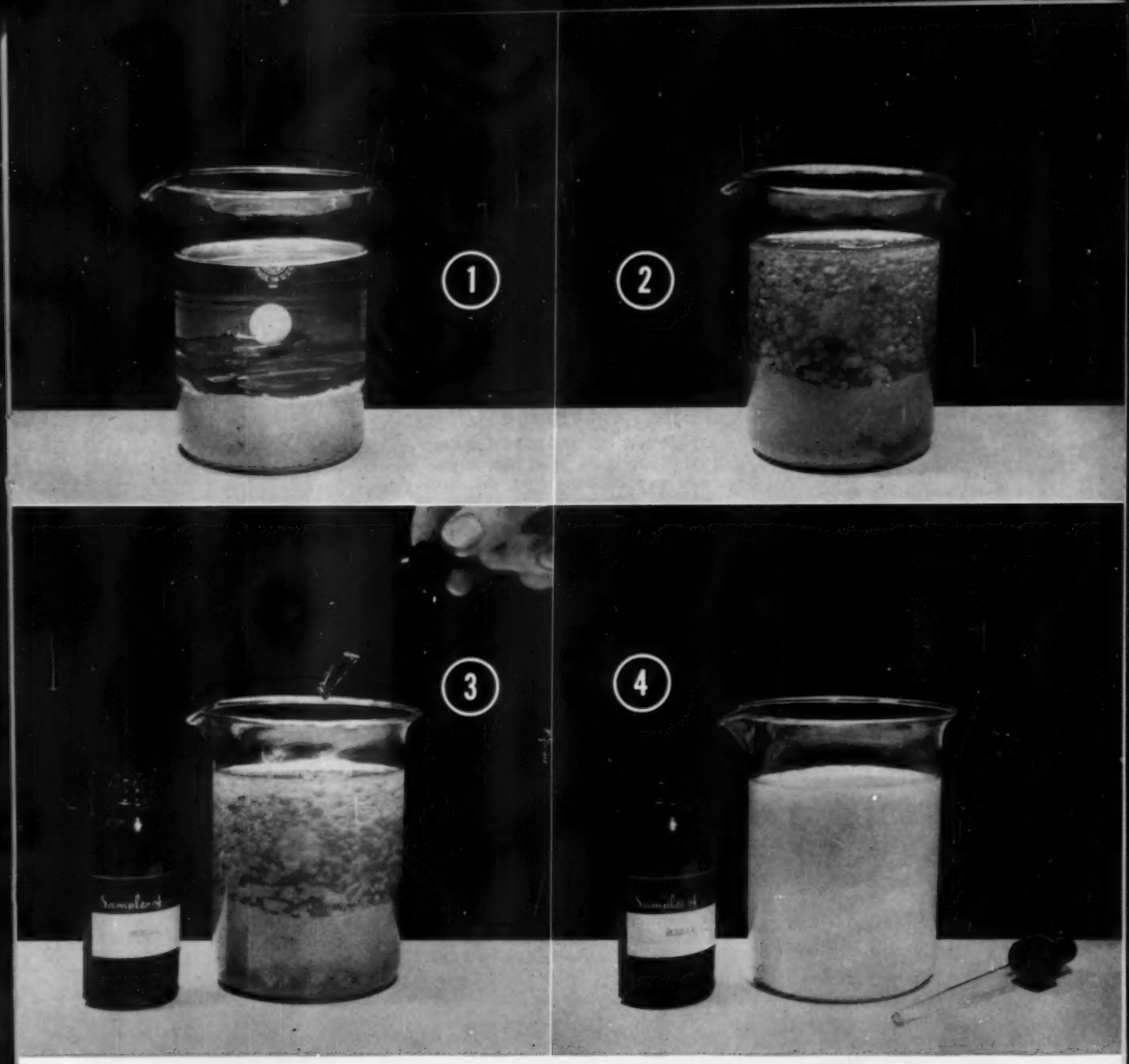
In an effort to solve the transportation problem for the tons of equipment required at the site, it was decided to take advantage of the high waters of the spring season and to ship everything by barge along the swift-flowing "highways" of the MacKenzie, the Nelson and the Liard rivers.

In January of this year, a fleet of Shell and contract trucks were gathered to transport the massive loads on the first leg of the trip to the north. Shell Rig No. 2, back in operation for this test (a National 100, capable of 12,000 ft.), and all the other heavier equipment and material, were trucked into Hay River on Great Slave Lake, while the lighter materials, including equipment for the camp, the bulldozers and other supplies were delivered by truck to Fort Nelson.

SUMMER DRILLING in the Northwest Territories is a rarity. Shell Oil Co. will drill a test in the Liard River area of MacKenzieland.

These shipments had to be completed early in the season before spring road bans were imposed, and the materials had to be stockpiled in readiness for barge shipment around the end of May. The equipment at Fort Nelson will move down the Nelson River to the Forks (where the Nelson empties into the Liard). From that point, it is some 125 miles down the Liard to the test location. This trip represents a total of about 250 miles and, encountering no difficulties, should be completed in 3 days.

The movement of the heavier equipment from Hay, although representing a longer trip of some 360 miles, is also expected to take 3 days. However, the first stages of this trip, across the lower end of Great Slave



Announcing MUDLAX– DOWELL'S NEW MUD DISPERSING AGENT

Mudlax* is a Dowell product used to help remove mud cake and excess drilling mud from wells; and to help remove mud lost to producing formations. It is added to the oil used in well clean-out work. Mudlax is effective on almost all types of muds. The above photographs show how it works.

Photograph number 1 shows the normal incompatibility of drilling mud and oil. Number 2 shows that even vigorous agitation does not mix the two. In photograph number 3, Mudlax is being added to the unstable emulsion of mud and oil. The recommended concentration is one to two per cent. Photograph number 4 shows the results. A mild agitation completely disperses the mud, forming a low-viscosity mud-in-oil emulsion.

Mudlax is not an acid. It is not intended to be a substitute for either Mud Acid or Breakdown Acid (BDA*). Mudlax is strictly a mud dispersing agent. It has proved more effective than acid for its intended use. Mudlax can also be added to the oil used to free stuck drill pipe. Ask your Dowell engineer for complete information. Mudlax is available through all 165 Dowell offices and service points.

Dowell, Tulsa 1, Oklahoma.

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Products for the oil industry DOWELL

A SERVICE DIVISION OF THE DOW CHEMICAL COMPANY

Lake and on the wide MacKenzie River to Fort Simpson, are expected to be easier, resulting in faster travel.

Most difficult portion of the trip is expected to be the last 70 miles up the Liard River to the location. The river depth varies quickly and it is also anticipated that the rapids on the swift Liard might present further difficulties, dependent on the depth of the water and the draft of the barges. Travel will be attempted only during the day until the water rises sufficiently to allow for safe night travel.

Yellowknife Transportation has been contracted to handle the shipment of the rig and the heavier materials — approximately 1,200 tons — from Hay River. The initial shipment will move out of Hay in a steel barge, with a capacity of around 400 tons. The balance of the supplies from Hay will be handled by barges, which will be brought down river from Aklavik as soon as water conditions permit.

The main distribution point for further supplies and for personnel will be Fort Simpson, 70 miles down river from the site, and travel will be either by light boat or bush aircraft. Once the water level drops markedly, barge travel will be impossible and it is planned to airlift supplies to the camp. If suitable ground can be located, construction of an airstrip will begin as soon as possible at the Liard location to allow a DC-3 and an Otter to service the site.

The selection of the ground for the strip will naturally be dependent on the type of ground, as will the selection of the drill site.

Shell is one of the leaders in the exploration of the Northwest Territories and the Yukon Territories as it currently controls rights to approximately 15,000,000 acres in this area. Showing the magnitude of development is the fact that it represents over 60% of the firm's 25,000,000 acres of holdings in all of western Canada.

As well as the recently announced 8,000-10,000-ft. wildcat in the Territories was the fact that Shell has already sent six geological surface mapping parties into the recent landplay area. Those parties are scheduled to cover between 60,000 and 70,000 sq. miles this summer. The base for this operation is 300 miles northwest of Norman Wells in the general Aklavik region.

These parties were in the field between June 1 and 10, with the season extending to around the middle of September.

Producer added to Desert Springs

WYOMING'S Desert Springs Unit is growing. El Paso Natural Gas Co. 4 Desert Springs Unit, Sweetwater County, flowed gas at the daily rate of 4,070 M.c.f. on drill-stem test at 5,079-5,105 ft. in the Upper Cretaceous sands.

This is the fourth test on the Green River basin unit—the third success. The discovery well, 1 Unit, 1 mile north of the No. 4 well, flowed 7,500 M.c.f. of gas per day from the Mesaverde at 5,887-5,954 ft. The No. 2 Unit, SE NW SE 22-21n-98w, made 12 M.M.c.f. daily from the Lewis (a new pay discovery), but the No. 3 well was a failure.

Wamsutter Unit . . . Another discovery in the eastern Green River basin is being tested. It is Ohio Oil Co.'s 1 Wamsutter Unit, C SE 12-20n-95w. The well made 7,500 M.c.f. of gas per day from the Mesaverde at 9,594-9,624 ft. Several other flows have been reported at this remote discovery, but final gage has not yet been taken.

Illinois picks up

DEVELOPMENT DRILLING is picking up in the Illinois basin. In Richland County, Illinois, 4 miles southwest of Olney, Jack Inglis Oil Properties has a discovery at 1 Morris Runyon in SE NE SW 25-3n-9e. Oil was discovered on drill-stem test of the Rosiclare.

In Gibson County, Indiana, 4 miles west of Mackey, Skiles Oil Corp. is apparently successful at the 1 Carl Parker in SE SW NE 19-3s-9w. The Aux Vases lime discovery swabbed 4 bbl. of oil per hour, natural.

In the area 3 miles north of Francisco, Gibson County, Mutual Oil & Gas Co. et al have completed two good wells. The 1 William A. Schlamp, NE SW NE 5-2s-9w, made 300 bbl. per day from the Benoist (Bethel) at 1,564-82 ft. The 1 C. D. Stroble-Aetna Life, SE NW NE 5-2s-9w, pumped 320 bbl. per day from the Benoist at 1,554-78 ft.

New pool opens near Decatur, Tex.

A NEW Strawn sand pool has been opened by Southern Union Gas Co. 4 miles southwest of Decatur in Wise County, Texas.

The company's 1 Womack in P. Ryan Survey A-705 flowed 130 bbl. of 39.2°-gravity oil on 24-hour potential test from Strawn sand section perforated with four shots per foot at 3,640-48 ft. and 3,652-62 ft. Gage was recorded through 26/64-in. choke, with tubing pressure reading of 130 lb., casing pressure 298 lb. and gas-oil ratio 1,970 to 1. Total depth is 6,250 ft.

The well is scheduled to be dually completed later from an Atoka conglomerate section near 5,400-6,100 ft. where it tested approximately 6 M.M.c.f.d. of gas, and that Southern Union plans to spud in soon about 1¼ miles to the east in an effort to determine the extent of the new structure. The second test will be designated 1-B Womack.

Sooner State has new Atoka pay

THE ATOKA (Lower Pennsylvanian) is a new pay in the Southeast Griggs field of Cimarron County, Oklahoma Panhandle.

The Texas Co. 1 Nield Unit, C SW NE 26-1n-9eCM, extreme southeastern Cimarron County in the far northwestern portion of Oklahoma, flowed 51 bbl. of oil and 2,820 M.c.f. of gas per day from the Atoka at 4,333-60 ft. Morrow also produces in this area as well as several other Pennsylvanian zones.

Field trip for oil finders

The Alberta Society of Petroleum Geologists is planning its eighth annual field conference to be held from August 20-23 at Nordegg, Alberta, Canada.

Registration will be held on August 20 and 21 at 401 Natural Gas Building, Calgary, and 120 Commercial Building in Edmonton.

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KANSAS PRODUCING ZONES AND AREAS

Age	Zone	No. of fields	Important Areas
Permian	**Lower Permian** Chase, Council Grove, Admire	4	Otis—Albert, Hugoton, East Winfield, El Dorado
Pennsylvanian	**Wabaunsee** Langdon, Tarkio, Wabaunsee	8	Central Kansas uplift, Pratt anticline, Hugoton embayment
	Shawnee Oread, Toronto, Peacock, Hoover, Topeka, Elgin	26	Central Kansas uplift, Sedgwick basin, Pratt anticline, Hugoton embayment
	Douglas Douglas, Ireland, Stalnaker, Lawrence, Tonganoxie	9	Central Kansas uplift, Sedgwick basin
	Lansing-Kansas City Lansing, Kansas City, Layton, Encill, Cleveland	549	All provinces except Forest City basin
	Pleasanton Pleasanton, Knobtown, Hepler	30	Forest City basin
	Marmaton Weizer, Peru, Wayside, Marmaton, Fort Scott, New Albany, Bandera, Labette	195	All provinces except Salina basin
	Cherokee Cherokee, Bartlesville, Squirrel, Prue	380	Sedgwick basin, Cherokee basin, Nemaha ridge, Hugoton embayment, Forest City basin
	Atoka-Morrowan Morrow, Atoka, Kearny, Keyes	28	Hugoton embayment only
	Penn. basal congl. Gorham, Sooy, Stapleton	70	Central Kansas uplift and its flanks
Mississippian	**Mississippian** Miss. lime, Miss. chert, Miss. chat, Warsaw, Kinderhook, St. Genevieve, Spergen	361	Cherokee basin, Sedgwick basin, Salina basin, Pratt anticline, Hugoton embayment
Devonian	**Misener? (Dev. or Miss. or both)** Misener sand, Sylamore	7	Sedgwick basin only
Siluro-Devonian	**Hunton** Hunton lime, Cooper, Chimneyhill	14	Sedgwick basin, Salina basin, Forest City basin
Ordovician	**Viola** Viola lime, Kimmswick	112	Central Kansas uplift, Pratt anticline, Nemaha ridge, Forest City basin, Sedgwick basin, Salina basin
	Simpson Simpson sand, St. Peter, Wilcox	110	Central Kansas uplift, Pratt anticline, Nemaha ridge, Sedgwick basin
Cambro-Ordovician	**Arbuckle** Arbuckle Group, Bonneterre, Eminence, "Siliceous lime"	400 +	Central Kansas uplift, Cambridge arch, Pratt anticline, Nemaha ridge, Cherokee basin, Hugoton embayment
Cambrian	**Reagan** Reagan sand, Lamotte	10	Central Kansas uplift, Cambridge arch
Precambrian	**Precambrian** Granite, granite wash	7	Central Kansas uplift

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New bulletin describes

Petroleum reservoirs in Kansas

ON THE BASIS of Kansas Geological Survey records, oil and gas reservoirs in Kansas have been classified into 18 zones, the geographic and geologic aspects of which are discussed in a new bulletin released by the survey "Oil and Gas Investigations No. 16," published by the University of Kansas, State Geological Survey of Kansas, Lawrence. This new release by Paul Lorenz Hilpman contains two valuable reference pieces —a map of Kansas fields showing their producing zones, and a set of maps showing the areal distribution of producing fields by zones.

The 18 producing units in Kansas are:

... **Precambrian.** To date production from this zone has been restricted to the Central Kansas uplift. Oil has accumulated in joints and fractures within the basement rock and within the porous, conglomeratic wash. It is doubtful that the source beds were Precambrian in age; probably the oil came from rocks younger than Mississippian.

... **Reagan.** Production from this Cambrian zone is restricted to the Central Kansas uplift and the Cambridge arch. The Reagan is known to be widespread outside these two provinces, but seemingly oil accumulates in this zone only in areas where the beds have been truncated by erosion and subsequently overlain by impermeable strata.

... **Arbuckle.** In accord with the porosity development, the areas of Arbuckle production are restricted to the Central Kansas uplift, Cambridge arch, Pratt anticline, and the Nemaha uplift, and the Cherokee basin.

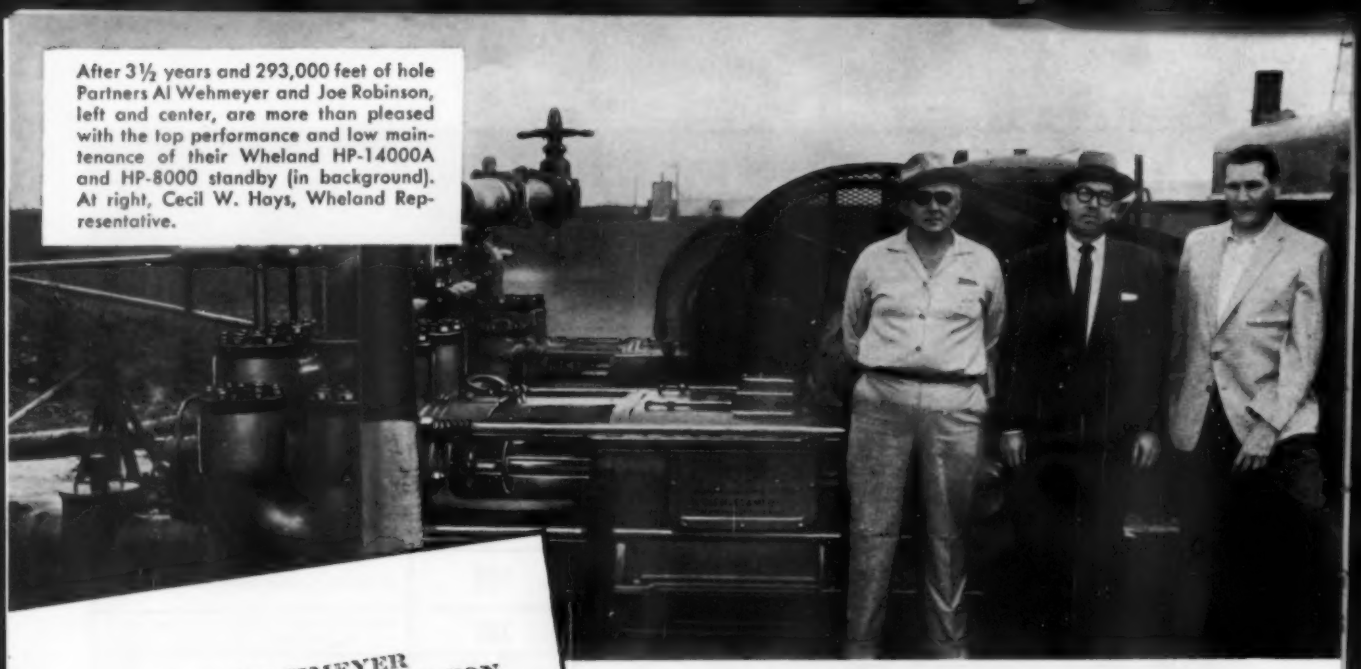
... **Simpson.** Production from the Simpson is reported in several provinces. Simpson production seemingly is related to structural pinchouts, stratigraphic traps, and erosional outliers.

... **Viola.** Viola production is widespread except in the Hugoton embayment, Cambridge arch, and the Cherokee basin. Rocks equivalent to Viola have been found under more than half of Kansas.

... **Hunton.** Current production from the Hunton is restricted to the Sedgwick, Salina, and Forest City basins, where much of the oil has accumulated along Silurian pinchouts beneath the unconformably overlying Devonian.

... **Misener.** Oil from this zone is reported only in the Sedgwick basin.

... **Mississippian.** Mississippian zone production is reported in the Cherokee, Sedgwick, Salina basins,



After 3½ years and 293,000 feet of hole Partners Al Wehmeyer and Joe Robinson, left and center, are more than pleased with the top performance and low maintenance of their Wheland HP-14000A and HP-8000 standby (in background). At right, Cecil W. Hays, Wheland Representative.

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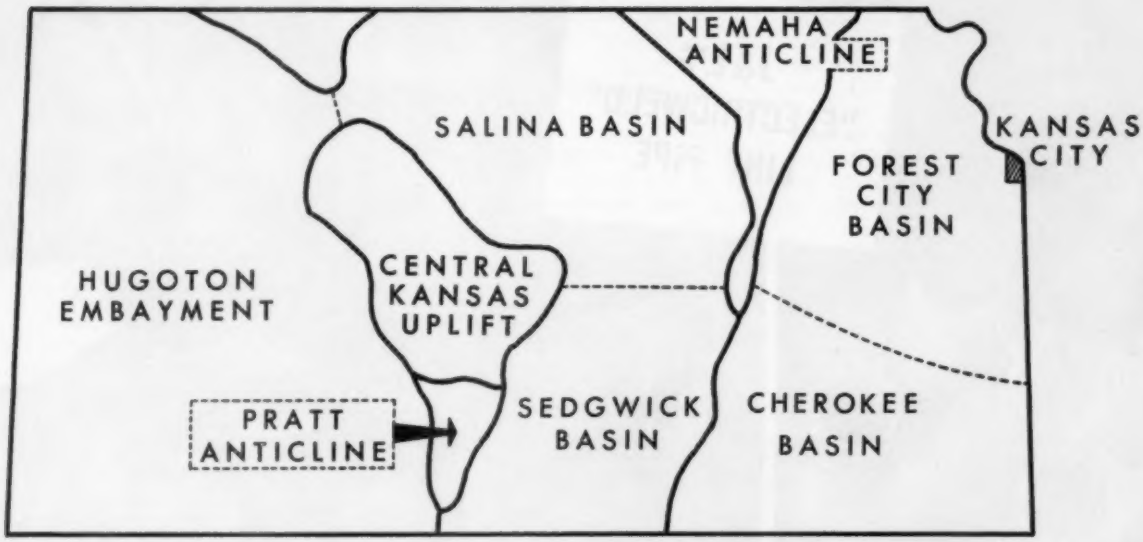

KANSAS has five major oil basins, and three major anticlinal structures. The most prolific source of oil in the state is the Central Kansas uplift. The biggest producing basin is the Sedgwick.

Pratt anticline, and Hugoton embayment.

... **Pennsylvanian basal conglomerate zone.** Rocks of this zone were developed along a major unconformity in much the same manner as the granite wash. Lithologically, the zone is related to the strata that lie beneath it.

... **Atokan and Morrowan.** Current knowledge indicates that rocks of this zone in Kansas are restricted to the Hugoton embayment.

... **Cherokee.** Rocks of this lower Desmoinesian zone are generally clastic, shale predominating over sandstone. A few thin limestone beds occur in the zone.

... **Marmaton.** Marmaton oil is found in all areas except the Salina basin.

... **Pleasanton.** The Pleasanton zone includes all rocks above the Missourian unconformity and below the Hertha limestone (base of Kansas City group).

... **Lansing-Kansas City.** Although the Lansing-Kansas City zone is not the most prolific zone in Kansas, it has been found productive in more fields than any other zone.

... **Douglas zone.** The Douglas zone includes all the strata that lie above the Missourian-Virgilian unconformity and below the base of the Oread limestone.

... **Shawnee zone.** The Shawnee zone includes all strata from the base of the Oread limestone to the top of the Topeka limestone.

... **Wabaunsee zone.** This zone comprises the uppermost rocks of the Virgilian series. It includes all strata above the Topeka and below the Pennsylvanian-Permian contact.

... **Lower Permian.** Rocks of the lower Permian zone are equivalent to the Wolfcampian series in Kansas, which includes all strata above the Pennsylvanian - Permian contact and below the base of the Sumner group. Production is obtained from stratigraphic traps within the porous dolomitic facies.

Gas well completed in eastern Kentucky

IN the Pike County sector of Big Sandy gas field, Kentucky West Virginia Gas Co. has completed a good well at its 6,410 Jesse Bartley.

Located on Right Fork of Dry Fork of Marrowbone Creek, the test initialled for a gage of 2,157 M.c.f.d. of gas on natural flow.

Total depth was 4,382 ft. in Devonian brown shale topped at 3,753 ft. Gas was encountered from 3,954 to 4,382 ft. in several zones. Rock pressure was 575 lb. in 32 hours.

Formations explored in eastern Kentucky

United Fuel Gas Co. is drilling at 7,200 ft. on their rank wildcat 28 Fordson Coal Co. Located on Left Fork of Elkhorn Creek near town of Sizerock in Leslie County, test is designed to explore sedimentary formations never as yet probed in eastern Kentucky. Well is now possibly in the Cambrian section of the Knox dolomite and is expected to reach basement rock. Rotary tools are being employed.

Utah's confirmation try flows gas

THE CONFIRMATION TRY to southeastern Utah's Chinle Wash gas field in San Juan County, Paradox basin, is flowing gas. The well, U. S. Smelting, Refining & Mining Co. 1-4 Ohio-Navajo, S½ NW SE 4-43s-21e, flowed at the daily rate of 4,313 M.c.f. on 2-hour drill-stem test at 4,799-4,834 ft. in the Paradox-Pennsylvanian.

The Chinle Wash gas discovery, completed last year, flowed 9,735 M.c.f. of gas per day from Paradox perforations at 4,917-38 ft. The confirmation try is ¾ mile northeast of the discovery well.

Bonanza ready to start Las Vegas wildcat

Bonanza Oil Corp. reportedly was ready to resume drilling on the 2,023-ft. 1 Government Consolidated southwest of Las Vegas. This wildcat was originally started in March 1957, but has been suspended for months.

Deep Creek unit coring in Alaska

Standard Oil Co. of California was coring below 13,793 ft. on 1 Deep Creek Unit, its joint test with Richfield Oil Corp. in the Ninilchik region of southern Kenai Peninsula.

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Wildcatting slumps, so

California drillers extend old fields

WITH WILDCATTING off about 33% this year, California operators are concentrating their efforts on extension tests around recent discoveries. A review of current stepout and extension drilling includes these interesting tests:

... **In the Buena Vista field** of Kern County, Tidewater Oil Co. was working on what appears to be a highly successful westerly offset to its deeper pool discovery of last November on the north edge of the field. The new Tidewater well, 545 TWA-ROCO, flowed at a 1,400-bbl.-daily rate on a formation test of an interval at 5,211-5,361 ft. It tested for a similar rate in another interval at 5,221-5,361 ft. Tidewater was preparing to test both intervals together. The discovery well producing interval was 5,059-5,199 ft.

... **E. A. Bender,** operator, was moving out the drilling rig preparatory to completing a southwest offset to his March Stevens zone discovery on the south edge of the old area of Canfield Ranch field in Kern County. Bender gun-perforated four holes per foot in the interval 8,387-8,402 ft. The discovery well zone was 8,388-8,402 ft.

... **Superior Oil Co.** completed a successful gas test in the Rio Bravo field of Kern County in a sand not generally productive elsewhere in the field. Exact perforation depths were not revealed but total depth of the test was 6,485 ft., plugged back to 6,354 ft.

... **Golden Bear Oil Co.** missed with a 2,603-ft. extension test ½ mile from the nearest production in the Sharktooth area of Round Mountain field, also in Kern County.

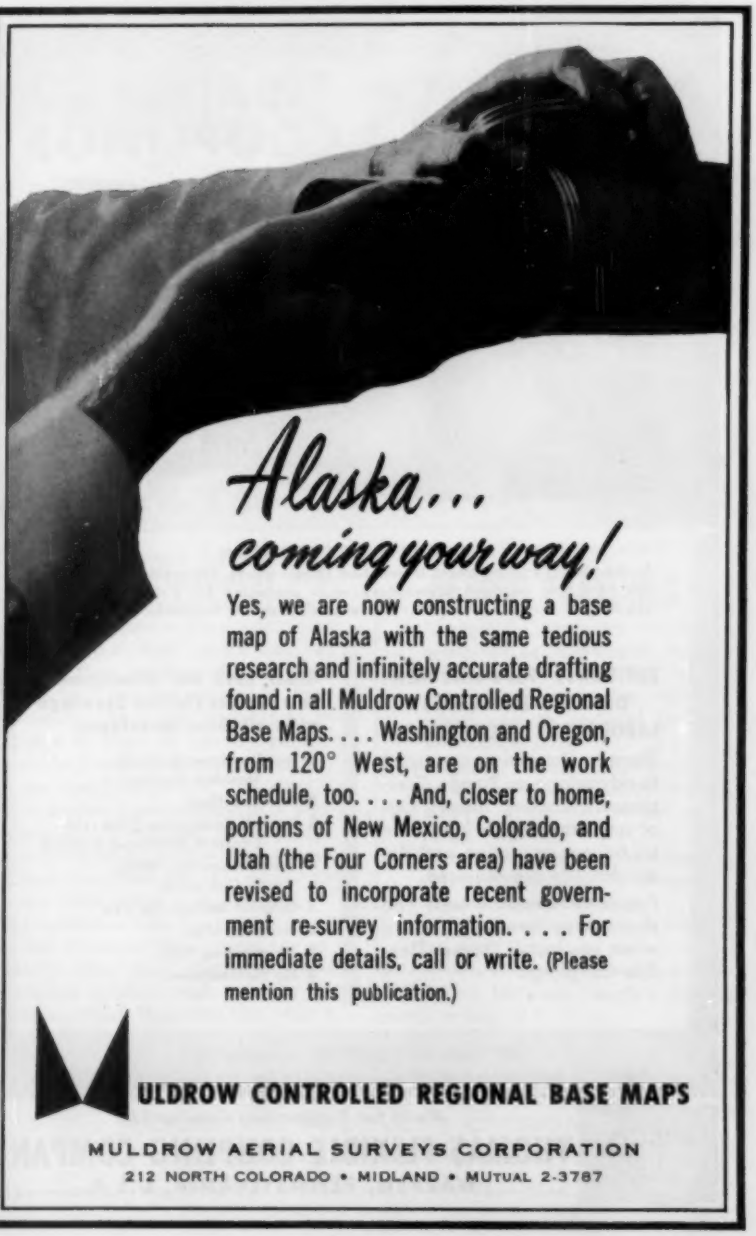
... **In the northwest** section of Ten Section field, Shell Oil Co. was hanging 2½-in. tubing in an offset to Shell's Northwest new-pool discovery. The offset, northwest of the discovery well, was drilled to 9,912 ft. and plugged back to 9,560 ft. for completion.

... **In Kings County** in Central California, Doyle B. Barnes was reaming and opening hole in a 3,422-ft. wildcat about 1½ miles west of the nearest production in the Orchard Ranch region of Pyramid Hills field.

... **T. B. Hess** reported bringing in a shallow cable-tool drilled extension test in the Griswold Canyon area of San Benito Canyon for 12 bbl. daily of 38°-gravity crude from a zone at 516-26 ft. This is about 3 miles north of the Vallecitos oil field.

California highlights . . . Union Oil Co. of California spudded in its first test on the Paramount film lot in downtown Hollywood. This initial well will be a 4,500-ft. straight-hole venture. The play is on a 60-acre parcel, 32 acres of which belong to Paramount Pictures Corp. . . . Standard Oil Co. of California, Western Operations, Inc., had reached total depth at 12,533 ft. with its first extension test to its El Rio field discovery in Ventura County. The El Rio field was 1958's first discovery in California . . . Hancock Oil Co. completed an offset south of its recent 11-13 KCL new-pool discovery in the Gosford field. The offset, 14-13 KCL, flowed 140 bbl. daily net of 32°-gravity crude through a 15-17/64-in. choke.

North Tejon . . . Richfield Oil Corp.'s first offset to its recent new pool discovery in the Highway area of North Tejon field flowed at a rate of 3,120 bbl. a day on a 1-hour test through a 20/64-in. choke. This offset, 83-24 ROC-KCL, is located about ¼-mile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south of the discovery just off Highway 99.

The perforated interval in 83-24 ROC-KCL is 8,681-9,063 ft. making it structurally higher than the discovery which was completed at 9,165-9,557 ft. The offset was cutting only 2% and was making 4,320 M.c.f., with 775-psi. tubing pressure.

Richfield was also nearing completion of its second offset to the discovery, 61-24 KCL I two locations west of the discovery well, 81-24 KCL I. This offset was being conditioned with mud. Total depth is 9,963 ft.

The other test associated with the Highway area of North Tejon field is Reserve Oil & Gas Co. 308-18 W-T which the operator was testing at 9,902-85 ft.

With one completion and one about to be completed, Richfield was grading location for a third offset at a site southwest of the discovery.

Shell hits at Ten Section . . . Shell Oil Co. completed 84-34 KCL as a new pool discovery in the northwest section of Ten Section field in Kern County. The discovery was completed in a Miocene-Stevens interval at 9,455-82 ft. and 9,490-9,545 ft. Initial production was flowing 89 bbl. daily, 9.2% cut, through a 20/64-in. choke.

This discovery offsets to the northwest another new pool discovery made earlier by Shell.

Golf course tests . . . A current tally on golf-course drilling in the Los Angeles metropolitan area shows these tests active:

. . . Signal Oil & Gas Co. was drilling ahead below 7,954 ft. on the municipal Rancho golf course and was setting 7-in. pipe in the 7,456-ft. wildcat it is drilling on the neighboring private Hillcrest Country Club.

. . . Hudson Oil & Gas Co. was rigging a rotary to start its first test of the exclusive Los Angeles Country Club.

All three golf-course wildcats are located on the edge of Beverly Hills in fashionable West Los Angeles. Rancho and Hillcrest are immediately south of the 20th Century Fox film studios where Universal Consolidated Oil Co. has had a highly successful drilling program going for several years and the Los Angeles Country Club is north of the movie studio.

Three other residential drilling projects in Los Angeles are in various stages of development:

. . . Union Oil Co. was drilling below 600 ft. on its Paramount movie studio test in downtown Hollywood.

. . . Richfield Oil Corp. has selected a drill site on famed Sunset Boulevard for a test of its Silverlake district holdings.

. . . Guiberson & Burke, operators, have selected a site for their test of the old Salt Lake field on the southeast edge of Hollywood. Union's Paramount wildcat is also a Salt Lake field test.

Wyoming gets gas find in Wind River

A CROW MOUNTAIN - TRIASSIC gas discovery was reported in the Little Dome area of Fremont County in Wyoming's Wind River basin. The shallow gas strike flowed at the daily rate of 7,640 M.c.f. from perforations at 1,384-90 ft.

Location of this new gas hit is 6 miles east of Sheldon Dome. Drilling in Little Dome area has met with failure previously.

Sunray drilling ahead in Oregon

Sunray Mid-Continent Oil Co. was drilling below 5,900 ft. on 1 Standard-Lloyd-McCulloch on the Bear Creek Unit southeast of Prineville in Crook County. This test has been drilling since May 12.

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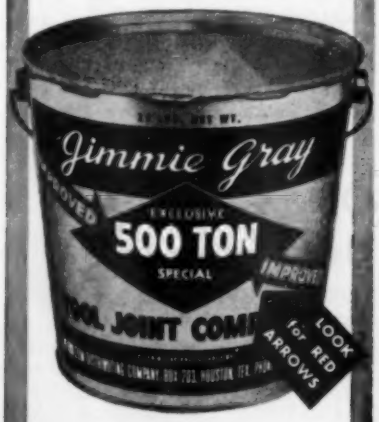

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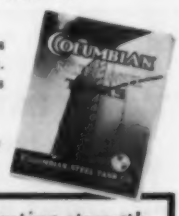

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Michigan crude looking for market

ADDITIONAL DRILLING in the new Zeeland play, Ottawa County, appears to hinge on successful negotiations now in progress for a market. To date no firm market has been developed for production of the discovery, 22°-gravity black crude.

Devine and Lang completed production tests on the 1 Kok, NW SE SW, Section 29-5n-14w, flowing an average 75 bbl. oil per day while maintaining 1,100 lb. on casing and 800 lb. on tubing. Production is from Salina A pay at 2,777-2,884 ft.

The wildcat is on a Carter Oil Co. acreage block, one of five farmout plays this year by Carter.

Ohio strike hints New Castle link

FURTHER EVIDENCE that the production in the southeast corner of Tiverton Township is part of the large New Castle field and the intervening area will produce is indicated by McCall Drilling Co. 1 Caroline Rahn, Lot 15, New Castle Township, Coshocton County. Clinton sand at 3,066-3,104 ft. and 3,116-33 ft. made 10 bbl. natural and 80 bbl. in 24 hours after fracture.

Ohio's Moreland extended

An extension of Moreland pool more than ¼ mile into Prairie Township, Holmes County, was reported by the operator, H. D. Collins et al.

The test on 1 David Yoder, Section 27, showed for 20 bbl. natural in Clinton sand at 3,470-97 ft. and 150 bbl. initial daily after fracture. Five additional wells in the pool with a total initial of 2,952 bbl. were reported completed for the week.

Successful Wildcats

ALBERTA

Mid West 2B-16-58-11 West Saddle Lake, LSD 2, 16-58-11w4. Colony oil discovery. TD 1,645 ft.

Canadian Delhi 7-20-16-3 Roseglen, LSD 7, 20-16-3w4. Medicine Hat gas discovery. TD 1,660 ft.

Banff et al 11-10-26-29 North Calgary, LSD 11, 19-26-29w4. Elkton gas discovery. TD 8,807 ft.

Husky-Permo el al 4-35-40-10 Choice, LSD 4, 35-40-10w4. Viking gas discovery. TD 3,1,50 ft.

CALIFORNIA

San Joaquin County: Porter Sesnon et al 13-23 "Sesnon-T.L.W.," SW NW 23-3s-6e, 2,500 M.c.f. daily gas, ⅝-in.

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choke, Perfs.. 3,860-70 ft., TD 3,890 ft. (New gas pool discovery in Vernalis region.)

Sonoma County: Blue-Cal Oil and Gas Corp. 3 Golden Gate, NW SE 30-5n-6w, 400 M.c.f., ¼-in. choke, Perfs. 680-81 ft., TD 944 ft. (Shallow gas pool discovery near Petaluma.)

MICHIGAN

Muskegon County: Muskegon Development Co. 1 Mion NW NE SW 29-12n-14w, Sheridan Twp., 9 miles west Kimball Lake oil field. IPP 2 to 3 bbl. oil per day. Elev. 733. Traverse lime 2,118 ft., pay 2,121 ft., TD 2,122 ft. (New oil pool.)

MICHIGAN

Montcalm County: McClure Oil Co. and I. W. Hartman 1 Maddhes, SW SE SW 16-11n-9w, Maple Valley Township. 6 miles south Reynolds oil field. IP 350,000 cu. ft. gas per day. Elevation 932 ft., Stray sand 1,130, 1,120-36 ft. TD. 1,137 ft. (New gas pool).

EASTERN NEW MEXICO

Eddy County: Miller Bros. Oil Co. 2 Western Development Co., 14-19s-28e, 14 mi. SE Artesia. IP 336 BOPD, 38°-gravity, TP 160 psi., pay 1,175 ft. TD 1,722 ft.

EAST TEXAS

Harrison County: LeCuno Oil Co. 1 Lou-Tex Oil Co., Thomas Gamblin Sur., A-287, 6 mi. NE Leigh. IP 582,000 cu. ft. gas, plus unestimated condensate, 10/64-in., TP 710 psi., Travis Peak 6,063-67 ft. TD 6,153 ft., elev. 213 ft.

TEXAS GULF COAST

Hardin County: Sinclair Oil & Gas Co. 1 McGill fee, Henry McGill League, A-38. Absolute open-flow potential 6,000 M.c.f. daily, GLR 32.5 M.c.f. per barrel, 62.8°, shut-in TP 2,549 psi., perforations 7,194-7,206 ft. (Yegua) and (dual completion) 9,600 M.c.f. daily, GLR 33.5 M.c.f. per barrel, 52.5°, shut-in TP 2,707 psi., perforations 7,561-71 ft. (Yegua). TD 8,500 ft. (second well and new pays in McGill field.)

Live Oak County: A. A. "Bus" Moore 1 Jack Brown, Sr., John McMullen Sur., A-30 (7 miles northwest of Mathis). Absolute open-flow potential 3,750 M.c.f. daily, dry gas, shut-in TP 1,427 psi., perforations 4,072½-76½ ft. (Vicksburg). TD 4,175 ft. (New field.)

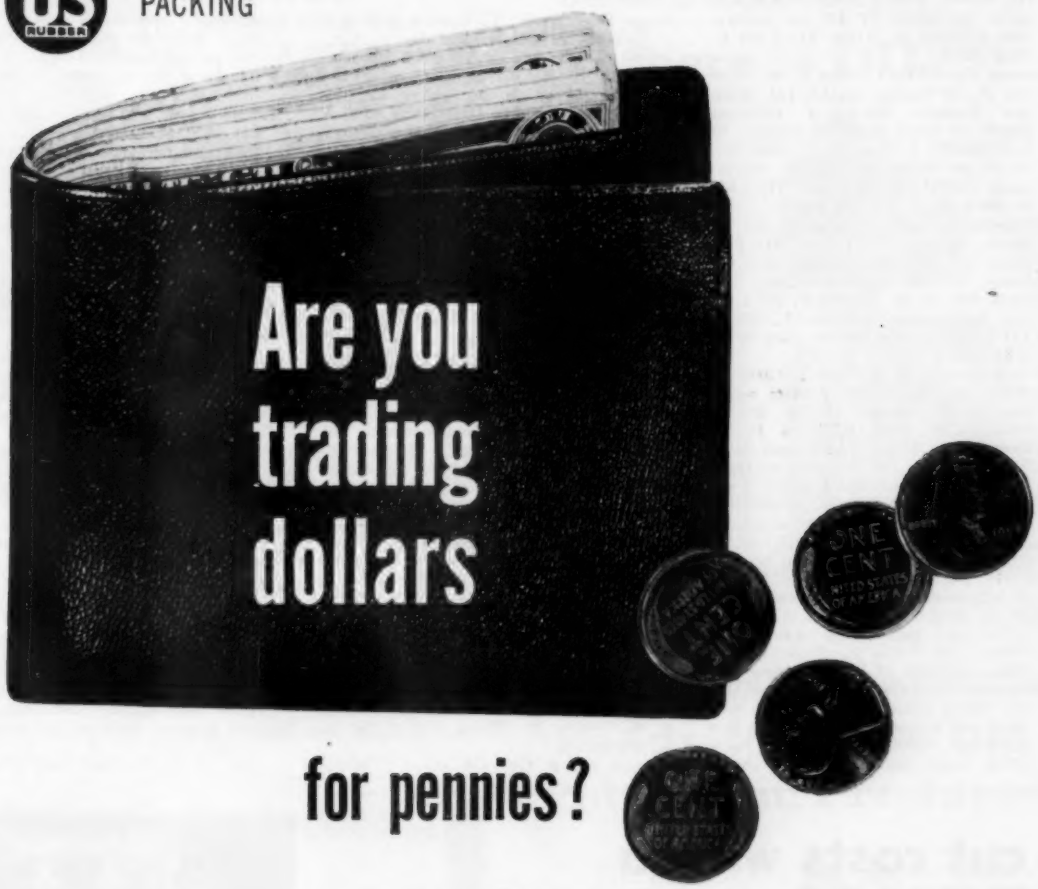
Kirkwood & Morgan, Inc., 1 Melton, Section 97, Charles F. Simmons Subd. (11 miles southwest of George West). Absolute open-flow potential 1,810 M.c.f. daily, GLR 91.5 M.c.f. per barrel, 57.1°, shut-in TP 2,076 psi., perforations 6,893½-6,900½ ft. (Wilcox-Slick sand). TD 7,500 ft. (New field—1½ miles northeast of Texam field.)

Matagorda County: J. S. Michael 1 D. P. Moore Est., R. P. T. Stone Sur. (1½ miles west of Bay City). Absolute open-flow potential 4,600 M.c.f. daily, GLR 19.2 M.c.f. per barrel, 52.2°, shut-in TP 3,475 psi., perforations 9,942-46 ft. (Frio). TD 11,008 ft. (New field—1¼ miles northeast of Lucky field.)

Nueces County: Harkins & Co. and Century Oil & Gas Co. 1 Gallagher, Section 30, George H. Paul Sub. of Driscoll Ranch. IP 66.14 BOPD, ¼-in., 40.3°, GOR 743 cu. ft. per barrel, perforations 5,602½-08 ft. (Frio). TD 5,646 ft. (New pay in Southwest Robstown field.)

Newman Brothers Drilling Co. et al 1

US RUBBER PACKING



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Walton, Section 15, Laureles Farm Tracts (2½ miles west of London). IP 115 BOPD, 9/64-in., 58.7°, GOR 675 cu. ft. per barrel, TP 475 psi. perforations 6,731-45 ft. (Frio). TD 9,125 ft. (New field).

Ramada Oil & Gas Co. and F. B. Cochran, Jr., 10 Hoting, Section 144, Braniger Brothers Subd. of Clarkson Ranch (4 miles south of Violet). IP 82.95 BOPD, 5/32-in., 22.1°, GOR 900 cu. ft. per barrel, TP 300 psi., perforations 3,108-14 ft. (Oakville). TD 3,550 ft. (New pay in Ramada field.)

Southwestern Oil & Refining Co. 1 Hinze, Section 14, George H. Paul Subd. "D" (½ mile northeast of Robstown). IP 154 BOPD, 5-32-in., 42°, GOR 900 cu. ft. per barrel, TP 1,100 psi., perforations 5,647-50 ft. (Frio). TD 5,837 ft. (New pay in East Robstown field.)

Wharton County: W. L. Puls 1 Allen, M. Weiss Sur. 22, A-559 (7 miles southeast of El Campo). IP 165 BOPD, ¼-in., 42.6°, GOR 6,232 cu. ft. per barrel, TP 1,760 psi., perforations 7,164-7,297 ft. TD 7,297 ft. (New oil reservoir in Allen-Twin Basin area.)

George R. Brown 1 Duncan, GH&H Sur. 33, A-176 (4 miles southeast of Lizzie). Absolute open-flow potential 18,500 M.c.f. daily, dry gas, shut-in pressure 1,841 psi., perforations 4,385-90 ft. (Frio), and (dual completion) 18,500 M.c.f. daily, dry gas, shut-in pressure 1,724 psi., perforations 4,407-10 ft. (Frio). TD 7,654 ft. (New field—3 miles southeast of Lizzie field.)

Robinson Oil & Gas Co. 1 Stockton, Lot 11, Henry Mills Sur. A-270 (3 miles north of Louise). Absolute open-flow potential 14,500 M.c.f. daily, GLR 292.5 M.c.f. per barrel, 51°, shut-in TP 2,005 psi., perforations 5,208-11 ft. (Frio). TD 5,400 ft. (New pay in Menefee field.)

Orange County: W. V. Bowles & Co. 9 Granger et al, William Dyson Sur., A-10 (1 mile southeast of Orange field). IP 92 BOPD, 5/32-in., 25.4°, GOR 328 cu. ft. per barrel, TP 325 psi., perforations 4,072-77 ft. (Miocene). TD 5,048 ft. (New pay in Orange field.)

Refugio County: Union Oil Co. of California 1-A Baumgartner et al, J. Power & J. Hewitson Sur., A-54. Absolute open-flow potential 17,000 M.c.f. daily, GLR 67,570 cu. ft. per barrel, 44°, shut-in TP 2,508 ft., perforations 6,550-62 ft. (Frio). TD 7,761 ft. (New pay in North Greta area.)

F. B. Cochran, Jr., 1 Oppenheimer et al, Section 36, Johnson & Pugh Subd. of Bonnie View Ranch (2 miles east of Woodsboro). Shut-in gas well, no gage, perforations 3,117-21 ft. (Catahoula). TD 3,626 ft. (New field.)

San Patricio County: Commonwealth Oil Co. 2 Anderson, Lot 4, Section 76, George H. Paul Subd. of Coleman-Fulton Pasture Co. (3 miles west of Portland). Absolute open-flow potential 3,300 M.c.f. daily, GLR 12 M.c.f. per barrel, 62.9°, shut-in TP 3,417 psi., perforations 9,367-77 ft. and 9,392-96 ft. (Frio). TD 9,910 ft. (New pay in Commonwealth field.)

Melba Production Co. 2 Sweatt, Section 7, Second Addition of Taft Farm Lands (4 miles northeast of Taft). Absolute open-flow potential 15,500 M.c.f. daily, GLR 48.3 M.c.f. per barrel, 65.4°, shut-in TP 2,323 psi., perforations 6,260-66½ ft. (Frio). TD 6,300 ft. (New field.)

Engeo Oil & Gas Co. et al 1 Mayo-Phillips Gas Unit, Section 59, George H. Paul Subd. of Coleman-Fulton Pasture Co. Lands (4 miles south of Taft). Absolute open-flow potential 6,400 M.c.f. daily, dry gas, shut-in. TP 1,570 psi., perforations 4,073-76 ft. TD 4,122 ft. (New pay in north White Point field.)

Tidewater Oil Co. 1 Richardson Unit, Lot 11, Geronimo Valdez Sur., A-269 (2½ miles northeast of Gregory). Absolute open-flow potential 10,800 M.c.f. daily, GLR 17,580 cu. ft. per barrel, 54°, shut-in TP 7,126 psi., perforations 10,866-72 ft., 10,874-83 ft., and 10,885-95 ft. (Lower Frio). TD 10,912 ft. (New field—Geronimo).

The Texas Co. 1 Havelka, Section 26, 4th Addition Taft Farm Lands Subd., John McKee Sur., A-189 (4½ miles northeast of Taft). IP 140.83 BOPD, X-32 choke, 32.1°, GOR 578 cu. ft. per barrel, TP 770 psi., perforations 5,546-50 ft. (Frio). TD 5,615 ft. (New pay in East Plymouth field.)

The Texas Co. 1 Tutt, Lot 1, Section 26, 4th Addition Taft Farm Lands Subd., John McKee Sur., A-189. IP 157.32 BOPD, X-32 choke, 24.2°, GOR 441 cu. ft. per barrel, TP 750 psi., perforations 5,562-67 ft. (Frio). TD 6,765 ft. (New pay in East Plymouth field.)

Texan Oil Co. 1 Lundberg, Lot 4, Section 30, 4th Addition Taft Farm Lands Subd. (6 miles northeast of Taft and 3 miles east of East Taft field). IP 184 BOPD, 3/8-in., 41°, GOR 380 cu. ft. per barrel, TP 225 psi., perforations 8,303-07 ft. (basal Frio). TD 9,105 ft. (New field—Ginny.)

Victoria County: Harkins & Co. et al 1 Dennis Ohrt et al, C. W. Vickery Sur., A-342 (4 miles west of Mission

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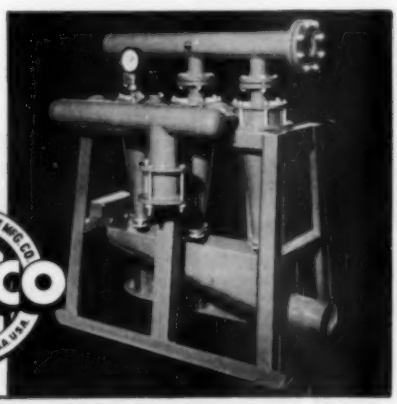

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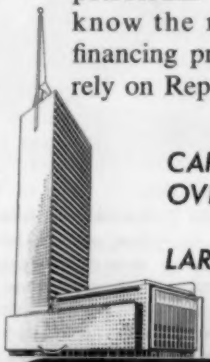

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Valley). Absolute open-flow potential 18,000 M.c.f. daily, dry gas, shut-in TP 653 psi., perforations 1,518-21 ft. (Frio). TD 9,315 ft. (New gas reservoir 4,000 ft. south of Meyersville gas area.)

Magnolia Petroleum Co. and Union Oil Co. of California 1-C Gertrude R. Keeran et al, Martin de Leon Grant (8 miles northeast of Placedo). IP 101.45 BOPD, 7/64-in., 38°, GOR 1,748 cu. ft. per barrel, TP 1,550 psi., perforations 5,882-86 ft. (Frio-Sinton sand). TD 8,850 ft. (New oil discovery in southeast of Southeast Keeran gas area.)

NORTH TEXAS

Wise County: Whitehall Oil Co. 1 J. P. Taylor, H. C. Saunders Sur., A-1282, 3 miles southwest Chico. Originally completed as gas well in Boonsville field, recompleted as oil discovery. IP 75 BOPD, 16/64-in., TP 150 psi., GOR 1846, 42°-gravity, Caddo conglomerate 5,393-96 ft. TD 5,928 ft.

SOUTHWEST TEXAS

Atascosa County: Roy Hofheinz and Appell Production Co. 1-A Ferry, I&GN Sur., A-428 (10 miles east of Pleasanton). IPP 15 BOPD (net), 12 per cent water, 20.4°, perforations 2,233-40 ft. TD 2,575 ft. (New field.)

Bexar County: George L. Rousseau and S. X. Callahan 1 Mendoza, D. Martinez Sur., A-9. IPP 10 BOPD, 42°, perforations 1,249-58 ft. (Navarro-Olmos). TD 1,270 ft. (New oil pay in Losoya area.)

Brooks County: Mills Bennett Estate 47 Mills Bennett Estate, J. J. Guerra Partition, El Tule Grant. IP 63.45 BOPD, X-28 choke, 46.8°, GOR 4,515 cu. ft. per barrel, TP 1,750 psi., perforations 5,825-32 ft. (Frio). TD 5,843 ft. (New pay in Mills Bennett field.)

Mills Bennett Estate 48 Mills Bennett Estate, J. J. Guerra Partition, El Tule Grant. IP 86.87 BOPD, X-38 choke, 40.1°, GOR 368 cu. ft. per barrel, TP 575 psi., perforations 4,183-90 ft. (Frio). TD 4,652 ft. (New pay in Mills Bennett field.)

Hillcrest Oil Co. 2 Jack Casey et al, Section 631, James T. Maupin Sur. Absolute open-flow potential 12,000 M.c.f. daily, GOR 100 M.c.f. per barrel, 56°, shut-in TP 2,331 psi., perforations 5,842-43 ft. TD 6,254 ft. (New pay in Bob Cooper field).

Dimmit County: Pronto Drilling Co. 2 Missouri Pacific, Lot 49, Section 165, Narciso Aguirre Sur., A-3 IP 115 BOPD, 3/16-in., 34°, GOR 657 cu. ft. per barrel, TP 210 psi., perforations 4,432-82 ft. (San Miguel). TD 4,517 ft. (New pay in Elaine field.)

Pronto Drilling Co. and Rainer Oil Co. 1 Louise Guerra et al, Charles McLaughlin Sur., A-856 (3½ miles southwest of Carrizo Springs). IPP 6½ BOPD, 38.6°, perforations 2,066-68 ft. (Navarro-Olmos). TD 3,310 ft. (New oil reservoir and segment in Wintergarden area.)

Union Producing Co. 1 Light, Section 63, Block A, I&GN Sur., A-525 (7½ miles east of Catarina). Absolute open-flow potential 640 M.c.f. daily, GLR 333 M.c.f. per barrel, 52°, shut-in TP 1,889 psi., perforations 5,615-19 ft. (Navarro-Olmos). TD 5,900 ft. (New pay in Light Ranch field.)

Duval County: Synura Corp. 2-E Atlee Parr, Block 55, Wheeler-Splane Subd., San Andres Grant, A-657 (7½ miles south of Benavides). IP 72.2 BOPD, ⅛-in., 40.2°, GOR 3,599 cu. ft. per

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Dodge medium- and heavy-duty trucks have always been built from a wide range of "Job-Rated" components to match a truck exactly to your job. This means that you aren't forced to pay for capacity you don't need, and you don't get undersized units that shorten your truck's life. Just look at the range of components today's line of *Power Giants* offers:

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barrel, TP 1,075 psi., perforations 6,671-87 ft. (Yegua), and 6,000 M.c.f. daily, GLR 21,390 cu. ft. per barrel, 60.9°, shut-in TP 3,059 psi., perforations 7,149-66 ft. (Yegua). TD 7,427 ft. (New pays in Lyle Wilson field.)

G. L. Rowsey et al 2 Elizabeth Parr, Section 113, GH&H Sur., A-258 (8 miles southwest of San Diego). IP 81.12 BOPD, P-32 choke, 47.6°, GOR 1,416 cu. ft. per barrel, TP 685 psi., perforations 4,211½-13½ ft. (Hockley). TD 5,101 ft. (New pay in Agua Prieta field.)

Hidalgo County: The Texas Co. 2-D Yturria, Porcion 44, Antonio Miguel Gano Grant, A-81 (11 miles northwest of Penitas). Absolute open-flow potential 3,020 M.c.f. daily, GLR 329 M.c.f. per barrel, 65.2°, shut-in. TP 1,832 psi., perforations 4,563-70 ft. (Frio). TD 5,115 ft. (New reservoir southeast of Bloomberg field.)

Bettis & Shepherd, Inc., 2 Alex Ramey, Las Bonita Banco 37 Sur. (9 miles southeast of Donna). Absolute open-flow potential 17,100 M.c.f. daily, GLR 223 M.c.f. per barrel, 54.7°, shut-in pressure 2,834 psi., perforations 7,127-33 ft., and (dual completion) 6,800 M.c.f. daily, GLR 164.7 M.c.f per barrel, 56.6°, shut-in pressure 2,783 psi., perforations 6,698-6,720 ft. TD 8,393 ft. (New pays in Cano field.)

Jim Hogg County: Gorman-Gichart-Howe 11-B East, Block 1, Hallmack Subd., El Randado Grant, A-113 (17 miles southwest of Hebbronville). IP 90 BOPD, 7/32-in., 37°, GOR 315 cu. ft. per barrel, TP 365 psi., perforations 3,788-95 ft. (middle Loma Novia). TD 3,799 ft. (New pay in South Prado field.)

J. E. Hillier 1 Allen Wood et al, Survey 82 (2 miles west of Randado). Absolute open-flow potential 3,000 M.c.f. daily, dry gas, shut-in TP 640 psi., perforations 2,710-25 ft. (Yegua). TD 3,900 ft. (New pay in Manila field.)

E. H. Smith et al 2 Major, Block 4, Hogg Ridge Subd., Las Animas Grant, A-244 (18 miles south of Mirando City). IPP 46.8 BOPD, 37°, open hole 3,404-10 ft. TD 3,410 ft. (New field.)

Killam & Hurd 2 Gruy et al, Section 3-7, Koehler Subd., Noriecitas Grant, A-365 (2½ miles north of Hebbronville.) IPP 23 BOPD (net), 74 per cent water, 26°, perforations 3,650-51 ft. (Mirando). TD 3,700 ft. (New reservoir in Gruy area).

Jim Wells County: Dillion & Bruns 1 Appling, Section 3, La Tinaja de Lara Grant (5 miles northwest of Alice). Absolute open-flow potential 29,000 M.c.f. daily, dry gas, shut-in TP 1,447 psi., perforations 3,340-46 ft. TD 3,396 ft. (New pay in Embleton field.)

McCarrick, Gouger & Mitchell 1 Starke, Section 503, I&GN Sur., A-248 (4 miles northwest of Orange Grove). Absolute open-flow potential 10,000 M.c.f. daily, dry gas, shut-in TP 1,006 psi., perforations 2,531-36 ft. (Heterstogina). TD 5,197 ft. (New pay and extension —Northwest Orange Grove.)

Jupiter Oils, Inc., 9 Nina Adams Estate, Los Presenos Grant, A-281 (5½ miles southeast of Alice). IP 128.24 BOPD, ⅛-in., 41°, GOR 800 cu. ft. per barrel, TP 800 psi., perforations 5,475-77 ft. (Vicksburg). TD 5,746 ft. (New pay in North Magnolia field Segment B.)

Miller & Fox 1 Guadalupe B. de Garcia, San Diego de Arriba Grant, Share 4 in Roman Numeral Share 11 (7 miles north of San Diego). IPP 14 BOPD (net), 90 per cent water, GOR 218 cu. ft. per barrel, 38.2°, perforations 3,380-83 ft. TD 5,754 ft. (New field.)

LaSalle County: Sutton Production Co. 1 Buckholt, Section 165, H&GN Sur., A-280 (9 miles southwest of Los Angeles). IP 12.13 BOPD, 3/64-in., 46°, GOR 1,600 cu. ft. per barrel, TP 1,350 psi., perforations 5,289-5,301 ft. (Wilcox). TD 5,655 ft. (New field discovery.)

Sutton Production Co. and O. W. McCurdy 1 Pfluger, Section 145, I&GN Sur., A-270 (5 miles south of Los Angeles). IP 120 BOPD, 5/32-in., 46.8°, GOR 600 cu. ft. per barrel, TP 475 psi., perforations 4,718-21 ft. (Wilcox). TD 5,510 ft. (New field—3 miles northwest of White Kitchen and Two Fingers fields.)

Starr County: Flourney Drilling Co. 1 Saenz, La Sal Colorado Grant (3 miles southwest of Santa Elena). Absolute open-flow potential 4,400 M.c.f. daily, GLR 23,360 cu. ft. per barrel, 54.8°, shut-in. TD 2,154 psi., perforations 5,564½-69½ ft. TD 5,600 ft. (New field—St. Patrick.)

Flourney Drilling Co. 1 Juana S. de Villareal, Share 3, Los Retaches Grant ½ mile southwest of Santa Elena). Absolute open-flow potential 68,000 M.c.f. daily, GLR 72.5 M.c.f. per barrel, 63.2°, shut-in. TP 2,075 psi., open hole 5,331-56 ft. TD 5,356 ft. (New pay in St. Patrick area.)

Sun Oil Co. 1 M. s. de Guerra, Lot 19, Section 299, HE&WT Sur. (24 miles northwest of Rio Grande City). Absolute open-flow potential 8,100 M.c.f. daily, GLR 128.3 M.c.f. per barrel, 50.6°, shut-in TP 1,693 psi., perforations 4,451-53 ft. (Queen City). TD

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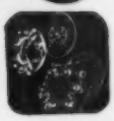
Small Spring Loaded

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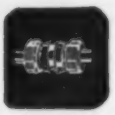
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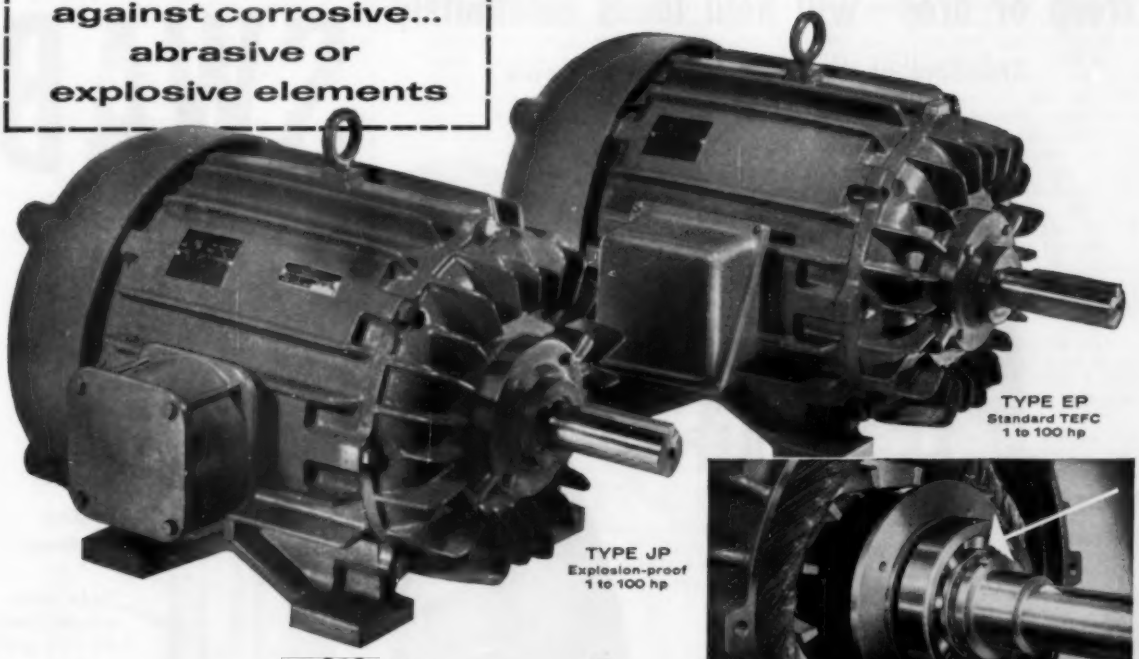

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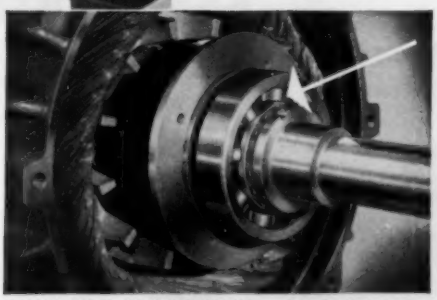
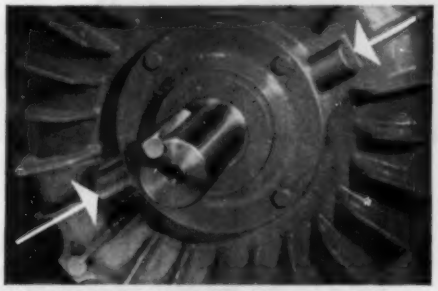


HEAVY DUTY BALL BEARINGS . . . The ball bearings used in these motors are of the highest quality, with more than ample capacity to provide long troublefree service under heavy loads.

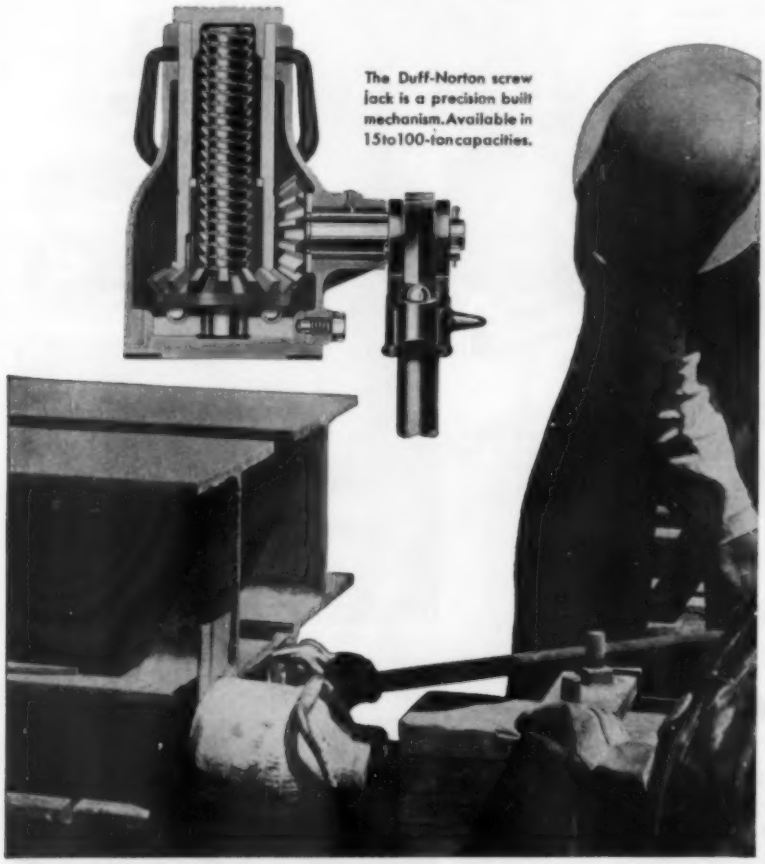


BEARINGS CAN BE RELUBRICATED . . . Factory installation will last for many years under normal service, but openings are provided to permit relubrication that adds years to motor life under severe conditions.

SEALS KEEP BEARINGS CLEAN . . . Both ends of these motors have running shaft seals to keep the bearings clean. Bearing housings are effectively sealed to prevent escape of grease.

Duff-Norton ball bearing screw jacks can't creep or drop—will hold loads indefinitely

Standard of the world for over 70 years



The Duff-Norton screw jack is a precision built mechanism. Available in 15 to 100-ton capacities.

Duff-Norton ball bearing screw jacks can be used upright or on their sides with equal efficiency—there is no fluid to leak, no air to "lock".

Duff-Norton ball bearing screw jacks, employing the basic inverted screw and nut principle, are locked in position when under tension and can't move up or down unless the jack handle is inserted and pressure applied to the ball bearing actuated gears in the jack base which turn the nut. Duff-Norton ball bearing screw jacks are foolproof, safe, and dependable. Fully enclosed and rugged, they seldom need lubrication or servicing.

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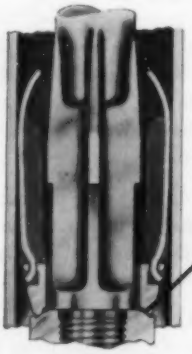

✻ Positive valving with each cup

Cup in closed position showing rubber impinged seal.

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Webb County: Ginther, Warren & Ginther et al 1-B O. W. Killam, Section 1807, GC&SF Sur. Absolute open-flow potential 9,000 M.c.f. daily, GLR 28.3 M.c.f. per barrel, 55.1°, shut-in TP 2,,23 psi., perforations 5,994-6,032 ft. (Wilcox). TD 8,677 ft. (Wilcox discovery well Pescadito salt dome.)

Ginther, Warren & Ginther et al 1-C O. W. Killam, Section 1394, CCSD&RGNG Sur. Absolute open-flow potential 1,700 M.c.f. daily, GLR 46.4 M.c.f. per barrel, 58.3°, shut-in. TP 3,116 psi., perforations 6,816-33 ft. (lower Wilcox). TD 9,100 ft. (New pay in Pescadito field.)

Glenn A. Martin 1 A. M. Bruni Estate, Section 597, CCSD&GRNG Sur., A-1154 (1¼ miles south of Aguilares). Absolute open-flow potential 10,300 M.c.f. daily, GLR 69,880 cu. ft. per barrel, 57.2°, shut-in TP 2,201 psi., perforations 5,965-81 ft. (Wilcox), and (dual completion) 17,000 M.c.f. daily, GLR 159 M.c.f. per barrel, 59.8°, shut-in pressure 2,035 psi., perforations 5,8432-56 ft. (Wilcox). TD 8,177 ft. (New field discovery—Martin.)

WEST CENTRAL TEXAS

Coleman County: Brannon & Murray Drilling Co. 1 Broyles, Chas. Wilson Sur. 305, 5 mi. E. Talpa. IP 82 BOPD, 16/64-in., 44°-gravity, GOR 600, TP 380 psi., Jennings sand 3,279-87, 3,292-98 ft. TD 3,430 ft., elev. 2,028 ft.

Haskell County. Bridwell Oil Co. 2-D Hendrick estate, Sec. 104, J. Matthews Sur., 12 mi. SE Haskell. IP 82 BOPD, 10/64-in., 40°-gravity, GOR 380, TP 160 psi., Palo Pinto 3,046-58 ft. TD 3,076 ft., elev. 1,481 ft.

Robert C. Humphrey 2 Elmer Wedeking, I. P. Wallace Sur. 57, 4 mi. N Stamford. IP 122 BOPD, 39/64-in., 39°-gravity, GOR 260, TP 80 psi., Canyon sand 2,600-04 ft. TD 3,661 ft., elev. 1,472 ft.

Stonewall County: Jim B. Curry 1 Kenneth Scott, 152-1-BBB&C Sur., 5 mi. N Hamlin, 1 mi. SE Tannehill and Strawn production. IPP 126 BOPD, 39°-gravity, Upper Frye 2,649-57 ft. TD 3,534 ft.

Ralph H. Lang 1 Abernathy, 14-D-H&TC, 5 mi. E Aspermont. IPP 64 BOPD, 40°-gravity, GOR 420, Canyon sand 4,066-75 ft. TD 6,037 ft., elev. 1,686 ft.

Stonewall County: Edwin L. Cox et al 1 Martin, Sec. 10, Blk. U, T&P Sur., 10 miles southwest Aspermont, 1¼ miles southwest Frankirk-Ellenburger field. IPP 115 BOPD, 42°-gravity, GOR 536, Ellenburger 5,986-94, 5,950-72 ft. TD 6,032 ft.

Taylor County: West Central Drilling Co. 3-E Crane, Stephens Rogers Sur., 3 mi. S. Potosi. IPP 44 BOPD, 42°-gravity, Dothan sand 1,573-81 ft. TD 1,581 ft.

Throckmorton County: Jocelyn Varn Oil Co. 1 A. B. Edsall, R. W. Steele Sur., 3 mi. in Elbert. IP 49 BOPD, 8/64-in., 45°-gravity, Strawn sand 3,194-3,201, 3,203-07 ft. TD 3,296 ft.

WEST TEXAS

Pecos County: Saturn Drilling Co. 1 Jennie Scharff, Sec. 24, Blk. 3, H&TC, 5 mi. SW Imperial. IP 42 BOPD, ¼-in., 37°-gravity, GOR 1200, TP 125 psi., Devonian 5,468-92 ft. TD 5,576 ft., elev. 2,424 ft.

Sabre Drilling Co. and W. D. Thorn 1 TXL "A," Sec. 27, Blk. 57, T2, T&P Sur., 2 mi. SW Orla. IP 358 BOPD, 16/64-in., 35°-gravity, GOR 405, TP 460 psi., Delaware sand 2,954-68 ft. TD 3,031 ft., ground elev. 2,972 ft.

Winkler County: Standard Oil Co. of Texas 13-34-E Baird, Sec. 13, Blk. B3, PSL Sur., 4 mi. NE Kermit, opens Joins pay in Kermit field. IP, calculated open flow, 40,500 M.c.f. gas plus 33 bbl. 63.5°-gravity condensate per 1,000 M.c.f., Joins (Lower Ordovician) perforations 10,276-10,312 ft.; IP from regular pay 95,000 M.c.f. plus 27 bbl. 60°-gravity condensate per 1,000 M.c.f., Fusselman 8,585-8,746 ft. TD 10,642 ft., elev. 2,926 ft.

ILLINOIS

Coles County: Earnie Zink 1 L. O. Walton, NW NE NE 13-12n-10e. IP 1,000 M.c.f. of gas per day, Penn. 442-72 ft. TD 478 ft. Extension to South Ashmore pool.

Washington County: Eastern Petroleum Co. 1 Jones, 26-3s-3w. IP 19 BOPD, 8 BW, 1,271-78 ft. TD 1,278 ft. Extension to Cordes pool.

KENTUCKY

Daviess County: Zogg Oil Co.-Harlan 1 George Lee, 10-N-28. IP 350 BOPD, Paint Creek sand 1,580-97 ft. TD 1,597 ft. Extension to Glenville Consolidated field.

SASKATCHEWAN

Canpet-Tidewater et al. 16-9-11-4 Fletwode, LSD 16, 9-11-4w2. Mission Canyon oil discovery. TD 4,113 ft.

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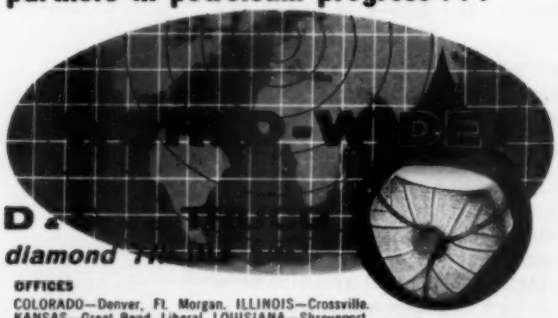

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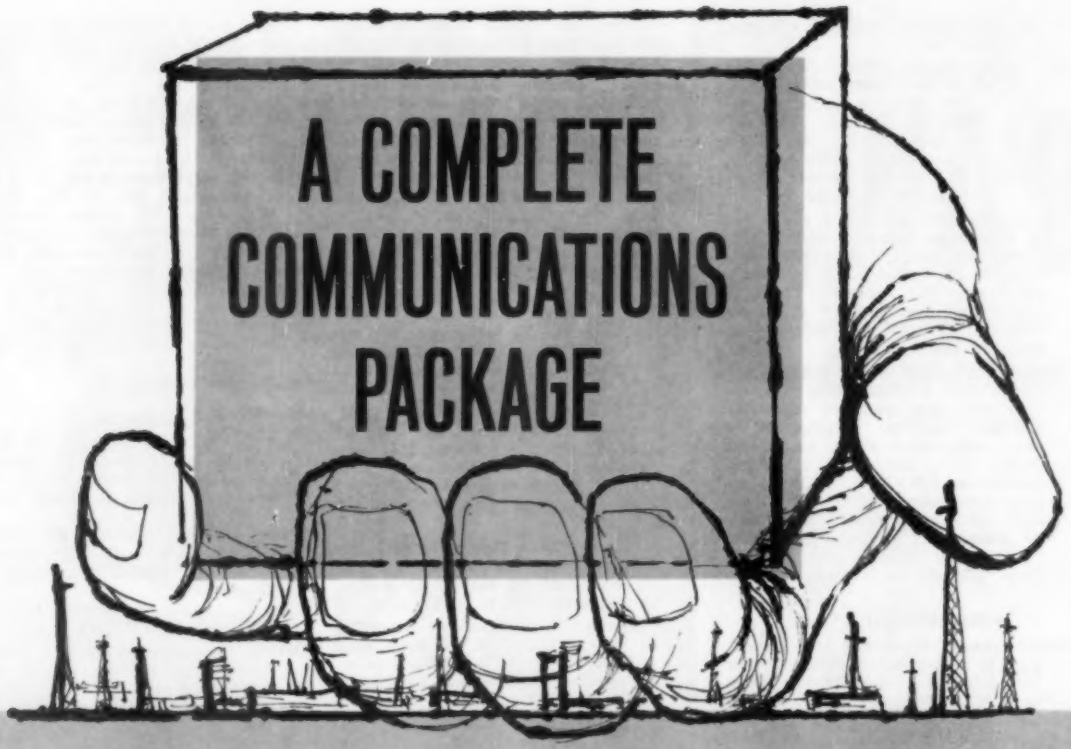

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Esso's Naden Hooks Big Job

THE PRESIDENT of the Fly Fishers Club of Brooklyn has more problems on his shoulders these days than luring wily brook trout.

He also is the new president of Esso Standard Oil Co., with the chief responsibility for running the vast refining and marketing subsidiary of Standard Oil Co. (N. J.).

William (Bill) Naden is taking over his new assignment at a time when the refining industry is in a recession. But he believes the outlook is a little better now than at any time since mid-1957. One of the signs of improvement, he feels, is the better balance of supply and demand in the Gulf Coast and Mid-Continent areas.

On the other side of the coin, he expects the rate of recovery to be slower than those of the two earlier postwar recessions.

Naden thinks refining has been the hardest hit segment of the oil industry. He cites figures on refinery spreads to back up his case. He says the refinery spread recently climbed back to 53 cents per barrel on the average, after sinking as low as 48 cents. He adds that these figures compare with the actual cost of refining crude of about 80 cents per barrel, excluding the cost of the crude.

Naden's comments on refining reflect his reputation as a man who is soft spoken, but a straight talker.

Outside interest . . . Dry-fly trout fishing — when he has time for it — is Naden's main avocation. He enjoys slipping away from his New York apartment on Park Avenue to a log cabin retreat in the Catskills.

William Naden

The cabin is headquarters for the fishing club, composed of 20 executives who are ardent fishermen. Naden's main responsibility is to see that no changes whatsoever are made in rustic surroundings. The cabin was built in 1895, the rug laid in 1912. Lumpy mattresses and kerosine lamps are of an early vintage.

Fishing and some bird hunting help keep the slender, wiry executive trim. He has not lost or gained more than a pound or two from the 138 pounds he weighed 25 years ago.

Background . . . Naden was born 57 years ago at Methuen, Mass. His childhood was spent in North Andover, Mass.

He graduated with a degree in chemistry from Lowell Textile Institute. His initial interest in chemistry grew out of summer jobs in local textile mills.

Like many executives in the Jersey Standard group, Naden came up through manufacturing. He joined Esso as a chemist at Everett refinery after 5 years as a chemist with a utility company at Lawrence, Mass.

He was made assistant to the general superintendent at Everett in 1929, and general superintendent in 1934. In 1943, he was made general superintendent of Esso's Baltimore refinery, where he took charge of building the big, new-type processing units needed to make aviation gasoline for wartime.

He became director of refining for District 1 of the Petroleum Administration for War in 1944. His task was to coordinate all refining and plant construction in the district.

Naden has been on the move up Esso's executive ladder since the war, starting as manager of employe relations. He became general manager of manufacturing in 1949, a vice president in 1950, and executive vice president in 1955. He has been a director since 1949.

Future . . . Naden looks for the excess in refining and transportation capacity to be over in 2 years. He then expects renewed expansion to get under way.

The future is also the concern of Naden's one outside interest other than fishing. It is the future of youth. He is chairman of New York City Junior Achievement, Inc., the largest junior-achievement group in the country.

Personals

Tom H. Pierson, director of engineering for Texas Butadiene & Chemical Corp., has resigned to join Eggelhof Engineers, Inc., Houston, as vice president and a director. Pierson was a vice president of Eggelhof before joining Texas Butadiene & Chemical in 1956.

Cecil V. Brock, Sinclair Oil & Gas Co. district foreman at Norman, Okla., has been transferred to Madill, Okla., to succeed **Robert R. Stallings,** who has moved to Silsbee, Tex. Brock will be replaced in Norman by **Doyle F. Cheatwood,** formerly assistant district foreman at Yale, Okla. **Glen D. Unterkircher,** assistant district foreman in Sedan, Kans., has been moved to Yale in the same capacity. **Clayton Wheeler,** Vidalia, La., assistant district foreman, will succeed Unterkircher in Sedan.

Elliott Bratt, president of Bratt Oil Co., has been named manager of Rocky Mountain operations for Alco Oil & Gas Co. Alco recently purchased Bratt Oil.

H. C. Charles has been appointed assistant to the vice president of Phillips Petroleum Co.'s land and geological department. Charles was formerly head of activities in the Osage County, Oklahoma, area. **H. S. Knight** will take over as director of Osage activities in addition to his duties as northeast region manager.

Lloyd A. Hamann, formerly manager of production for Seaboard Oil Co. in Denver, has been named assistant district production superintendent for The Texas Co. in Bakersfield, Calif.

Arthur W. Ball, geologist in Bartlesville, Okla., for Phillips Petroleum Co., has been transferred to Venezuela as district geologist.

Carl M. Morris has been transferred by Ohio Oil Co. from Midland, Tex., to Casper, Wyo., where he will supervise rotary-drilling operations.

Aubrey R. McKinney has joined the Whiting, Ind., research laboratory of Standard Oil Co. (Ind.) as senior research scientist.

Personals

Leon Joe Abrusley, intermediate engineer in Covington, Okla., for Sinclair Oil & Gas Co., has been transferred to Ardmore, Okla., and promoted to production engineer.

Sir John Henry Dacres Cunningham, chairman of Iraq Petroleum Co. and associated companies, has retired. A British admiral, Sir John was Allied Naval Commander, Mediterranean, at one time. He served as British First Sea Lord and Chief of Naval Staff from 1946 to 1948.

Stewart P. Coleman, a director of Standard Oil Co. (N. J.), has received a decoration from the Italian Government recognizing his work as chairman of the Middle East Emergency Committee during the Suez Canal crisis last year.

C. Willis Stose has moved up from general superintendent to manager of Atlantic Refining Co.'s Philadelphia refinery. He succeeds **D. T. Shaw,** manager since 1952, who has retired. Stose joined Atlantic in 1925. He was head of the company's crude-oil purchases and sales department before becoming general superintendent at Philadelphia.

Richard E. Powers, Sinclair Oil & Gas Co. assistant division petroleum engineer in Midland, Tex., has been promoted to division engineer. **Robert R. Marmor,** senior petroleum engineer, has moved up to succeed Powers.

Eugene L. Mikolajczyk, formerly a student at Texas Technological College, Lubbock, has joined Magnolia Petroleum Co. as petroleum engineer trainee in Healdton, Okla.

Dr. C. W. Smith, technical assistant to **Dr. Harold Gershinowitz,** president of Shell Development Co., in New York, has been transferred to the company's Emeryville, Calif., research center. He will be assistant head of the plastics and resins department at Emeryville. Smith had been on 2-year assignment in New York. He has been succeeded there by **R. W. Martin.**

F. W. Gipson has been transferred from Midland, Tex., to Pecos, Tex., by Continental Oil Co. as district engineer at the company's new drilling and production office at Pecos. **Charles Fourniquet** has been named drilling foreman there with **L. C. McCrary** as district clerk.

NEW TOP MEN of PESA are W. T. Powell, right, president, and W. D. Wilson, left, vice president.

Powell Elected New PESA President

Petroleum Equipment Suppliers Association's annual meeting at Quebec saw election of five new officers and reelection of one to top association posts.

W. T. Powell, vice president of Continental-Emsco Co., Los Angeles, succeeds Grover Kilgore of Halliburton Oil Well Cementing Co. as president of PESA. Wallace D. Wilson, president of Wilson Supply Co., Houston, was named vice president. H. R. Safford, Jr., was reelected executive secretary.

Other officers will be R. H. McLemore, president of Otis Engineering Corp., Dallas, elected general chairman of the service division; R. G. Ayers, vice president of Bovaird Supply Co., Tulsa, general chairman of the supply division; and T. A. Fullinwider, sales manager of domestic oilfield sales for Mission Manufacturing Co., Houston, who is general chairman of the manufacturing division.

Directors named by PESA include:

Eastern district . . . Karl Elliott, Acme Fishing Tool Co.; Rainey Elliott, Jones & Laughlin Supply Division; Jene Harper, Franklin Supply Co.; Lloyd Lanphere, Ajax Iron Works; Donald W. Mackie, Jr., Bradford Supply Co.; Frederick F. Murray, Oil Well Supply division of United States Steel Corp.; J. T. Murray, Midway Supply Co.; A. W. McKinney, National Supply Co.

Directors-at-large are Bernard P. McDonough, Parkersburg Rig & Reel Co.; Paul Scherf, Alten Foundry & Machine Works, Inc.; John G. Seiler, Tube Turns division of Chemetron Corp.; H. Bernard Wehrle, McJunkin Corp.; and Mason B. Jones, S. M. Jones Co. Ferd J. Spang, Spang & Co., is director emeritus.

Mid-Continent and Rocky Mountain district . . . R. A. Baker, Cabot Shops, Inc.; F. E. Bernsen, Lucey Products Corp.; W. L. Butler, W. C. Norris, Manufacturer; Lester W. Hall, Eastman Oil Well Survey Co.; S. J. Iverson, Iverson Supply Co.; Grover Kilgore, Halliburton Oil Well Cementing Co.; K. W. Lineberry, Black Sivalls & Bryson, Inc.; M. G. McCool, American Iron & Machine Works Co.; R. H. McLemore, Otis Pressure Control, Inc.

Directors-at-large are John G. Staudt, Dowell division of Dow Chemical Co.; W. J. McWilliams, Republic Supply Co.; C. R. Zimmerman, Bethlehem Supply Co.; and D. D. Bovaird, Bovaird Supply Co.

Southwestern district . . . H. H. Allen, Cameron Iron Works; Howard B. Book, Reed Roller Bit Co.; Ken W. Davis, Mid-Continent Supply Co.; Ott Hammer, Dresser Operations; Frank L. Hereford, Murray-Brooks, Inc.; Elliott Johnson, Schlumberger Well Surveying Corp.

W. H. Larkin, Larkin Packer Co.; L. A. Little, Lufkin Foundry & Machine Co.; John J. Neal, Lane-Wells Co.; George O'Leary, Houston Oil Field Material Co.; Ray O. Shaffer, Welex Jet Services; and

Richard E. White, Mission Manufacturing Co.

Directors-at-large are Fred M. Mayer, Continental-Emsco; M. E. Montrose, Hughes Tool Co.; and Wallace D. Wilson, Wilson Supply Co.

Pacific district . . . James Bere, Axelson Manufacturing Co.; Markley C. Brown, Hillman-Kelly; J. L. Evans, National Supply Co.; Don Grubbs, Oil Well Supply division of United States Steel; H. J. Hagn, Chicksan Co.; Harold E. Howard, Howard Supply Co.; Wendell M. Jones, Bethlehem Supply Co.

I. J. McCullough, McCullough Tool Co.; H. H. Peters, Technical Oil Tool Corp.; John J. Pike, Republic Supply Co. of California; W. T. Powell, Continental-Emsco; W. A. Wilson, Web Wilson Oil Tools, Inc.

Directors-at-large in the Pacific district are J. A. Crawford, Youngstown Steel Products Co.; E. S. Dulin, Byron Jackson Tools, Inc.; and T. Sutter, Baker Oil Tools, Inc.

W. D. Seyfried, assistant head of Humble Oil & Refining Co.'s research and development division at Baytown, Tex., has been promoted to head of the division. He succeeds **Dr. A. A. Draeger,** who has joined Humble's marketing department in Houston as manager of general office sales. He is responsible for chemical and petroleum products sales. Seyfried, a grad-

SEYFRIED

DRAEGER

uate of Vanderbilt University, joined Humble in 1938. He had been assistant head of research and development since 1948. Draeger had been head of the division since 1947. He served in Humble's executive program since that time, however, as technical assistant to the manager of operations, head of the technical service division, and manager of technical and research sections.

Marvin F. Hall has been appointed consulting gas engineer for Ebasco Services, Inc. He will be in charge of gas engineering activities of the consulting company. Hall has been with Ebasco since 1951. He was with Washington Gas Light Co. before that time.

H. M. Karr, assistant manager of Shell Oil Co.'s manufacturing organization engineering department in New York, will become manager of technology for Shell Pipe Line Corp., a new position, August 1. He will headquarter in Houston.

H. C. Hopkins, formerly with Hilton Drilling Co., will head the newly opened Kansas City, Kans., office of Hudson Oil Co.

W. J. Westhoff, superintendent of Shell Oil Co.'s Sheridan, Tex., cycling plant, has been named superintendent of operations in the Tulsa area gas department. **D. A. Nicewander,** superintendent of the Wasson plants, Denver City, Tex., will succeed Westhoff at Sheridan.

Paul Bilger, chief engineer for Lake Superior Refining Co., has been named superintendent of the company's Superior, Wis., refinery. **Joseph I. Lanctot,** process foreman, becomes assistant superintendent in charge of operations. **Leo. M. Zalaznik,** maintenance foreman at the refinery, has been promoted to assistant superintendent in charge of maintenance. Bilger joined Lake Superior in 1955. Lanctot and Zalaznik have been with the company since 1951.

C. S. Rose, Tulsa division production superintendent for Sinclair Oil & Gas Co., is chairman of the company's unit operating committee for the Southeast New Hope Gibson Sand water-flood unit in Oklahoma's Garvin and McClain counties. Sinclair, as 30% interest owner, is project operator. **B. L. Howell,** senior petroleum engineer for Sinclair in Tulsa, is vice chairman, and **J. W. MacFarlane,** chief division production clerk, Tulsa, is secretary of the operating committee. A new production district office has been opened at Lindsay, Okla., to operate the project. **Chester R. Richards,** district superintendent at Sinclair's Carmi, Ill., production office, has moved to Lindsay as production superintendent. **Billie R. Burruss** has been promoted to district foreman and transferred to Lindsay from Seminole, Okla. **Ernest L. Rogers** is assistant district foreman at Lindsay. **Homer D. Melton, Jr.,** senior petroleum engineer in Tulsa, moves to Lindsay as district petroleum engineer. Also in the Lindsay office will be **Charles J. Fuller,** junior petroleum engineer; **Cleon Faught,** production clerk, who has been transferred from Chase, Kans.; and **Allen T. Claiborne,** former warehouseman at Madison, Kans., now at Lindsay in the same capacity.

TIERNAN

T. L. (Tom) Tiernan has been named general manager of D-X Sunray Oil Co.'s Tulsa refinery. He succeeds **Ed M. Dons,** who retired July 1. Five others have been promoted to manager of reorganized departments at the refinery. **Pierce M. Reynolds,** manager of operations and engineering, has been named manager, technical services. **John Holiway,** superintendent of light oils, cracking, and conversion, has been oppointed manager of light oils. **Carl E. Larson,** superintendent of lube oils, becomes manager, lube oils. **A. G. Field,** formerly operating supervisor of the catalytic cracking unit and the delayed coker, has been named manager, operations services. New manager of administrative services is **E. T. W. Hall,** formerly chief job analyst in the employe-relations department. **N. B. York,** assistant manager of the refinery, has been named assistant to the manager. He is scheduled to retire later in the year. Tiernan, new general manager, has been with Sunray and its predecessor companies since 1933. He was manager of the company's Allen, Okla., refinery and plant manager for Ucan Products Co., a subsidiary, before moving to the Tulsa refinery last year. Dons, retiring manager, had been with the company since 1922. He served as chief engineer, assistant general superintendent, and general superintendent before being named manager of the Tulsa refinery last year. He has been on leave of absence recently because of poor health.

Everett D. Selleck, plant superintendent at Brea, Calif., for Shell Oil Co., has been appointed Brea district superintendent.

Willard L. Roy, district engineer with American Climax Petroleum Corp., has been transferred to Nowata, Okla., from Coleman, Tex.

Perry McClanahan, tool pusher with Penrod Drilling Co., has been transferred to Houma, La., from Kinder, La.

Lewis A. Winkler, section head in charge of additives and chemical activities in Esso Research & Engineering Co.'s technical service unit, Linden, N. J., has been named head of the chemicals liaison unit in London. **Leo V. Mullen, Jr.,** group head in the additives section, becomes section head in charge of additives activities.

Personals

KNEBEL

G. M. Knebel, manager of the exploration division for Standard Oil Co. (N. J.), has been appointed senior exploration advisor, a new position. **William E. Wallis,** deputy manager of the division succeeds Knebel. Wallis will be replaced as deputy manager of exploration by **Vaughn C. Maley,** regional geologist. Knebel joined Jersey in 1924 as a geologist. He served as a director, vice president, and manager of Standard Oil Co. of Venezuela before becoming Jersey Standard's exploration manager in 1944. He is a past president of American Association of Petroleum Geologists. In his

WALLIS

MALEY

new post, Knebel will be available to consult with affiliates on exploration problems. Wallis had been deputy manager of exploration for Jersey since 1954. He was exploration manager for Creole Petroleum Corp. before that time. Maley transferred to the parent company 2 years ago from Humble Oil & Refining Co. He had been with Humble since 1927.

William J. Rogers, division petroleum engineer for Sinclair Oil & Gas Co. at Midland, Tex., has been promoted to assistant division production superintendent in Fort Worth. Rogers has been with Sinclair since 1937.

D. S. Wartick, district drilling foreman in Farmington, N. M., for Shell Oil Co., has been transferred to Calgary.

Wheeler G. Lovell, director of chemical research at Ethyl Corp.'s Detroit research laboratories, has been promoted to research advisor in charge of research planning, a new position. **Dr. W. B. Ligett,** associate director of chemical research, has been named chemical research director, succeeding Lovell.

W. N. Harman, engineer in Salt Lake City for Salt Lake Pipe Line Co., has been named division engineer in Boise, Idaho.

Jack H. Abernathy, president of Big Chief Drilling Co., has been named chairman of the 1958-59 United States Chamber of Commerce committee on commercial uses of atomic energy. The committee encourages private development of uses of atomic power.

George H. Ketchum, General Petroleum Corp., has been elected president of the Los Angeles Landmen's Association. Other new officers are **T. L. Lewis, Jr.,** Western Gulf Oil Co., vice president; **T. L. Stephenson,** Ohio Oil Co., treasurer; **W. H. McGurty,** Western Gulf Oil Co., secretary. Directors of the association include **R. L. Cormany,** Hancock Oil Co.; **F. W. Bush,** Union Oil Co.; and **K. M. Cook,** Richfield Oil Corp.

Bobby B. Robinson, Shell Oil Co. exploitation engineer, has been transferred to Ventura, Calif., from Farmington, N. M. **Carl D. Fairbanks** and **Ernest H. Pronske,** junior exploitation engineers in Shell's Los Angeles area office, have been promoted to exploitation engineers and transferred to Long Beach, Calif.

Roy Foy, Jr., driller with Stevens Drilling Co. in Henderson, Ky., has joined Texas Gas Transmission Corp. in Owensboro, Ky., as driller.

Wilfred B. Tapper, general manager of operations for Chaco Petroleum, S.A., Bolivian subsidiary of Tennessee Gas Transmission Co., has been named a vice president. Tapper was vice president of Halliburton Oil Well Cementing Co. and Welex, Inc., before joining Chaco Petroleum last year. Chaco is operator on a 900,000-acre lease in southern Bolivia held by itself and Bolivian subsidiaries of Union Oil & Gas Corp., Monsanto Chemical Co., and Murphy Corp.

R. T. Wells, director and manager of engineering research for Cities Service Gas Co., Oklahoma City, has retired. Wells joined Cities Service in 1916. He was named director and manager of engineering research in 1953.

N. E. Smith, Shell Oil Co. geologist in Tyler, Tex., has been transferred to Houston.

Anatole Safonov, formerly with Brazos Oil & Gas Co., has opened consulting offices in Sacramento, Calif.

J. P. Gasser, formerly executive vice president and member of the executive committee of Seaboard Oil Co., has joined Dresser Industries, Inc., as an executive vice president. As one of three Dresser executive vice presidents, he will direct activities of Lane-Wells, Ideco, Inc., Magnet Cove Barium, Security Engineering, Well Surveys, Dresser Dynamics, Southwestern Industrial Electronics, Hermetic Seal Transformer Co., and Dresser's Turbodrill division.

Ralph W. Johnson, radio field engineer for Sinclair Pipe Line Co. in Caney, Kans., has been promoted to radio supervisor in Independence, Kans.

W. L. Adkison has been transferred from Tulsa to the Lawrence, Kans., office of U. S. Geological Survey. **Harold J. Hayden** moves from the Tulsa USGS office to Denver.

V. L. Breland, tool pusher with Penrod Drilling Co., has been transferred to Houma, La., from Buras, La.

Kelly H. Roach, engineer with Superior Oil Co., has been transferred to Houston from Chickasha, Okla.

DEATHS

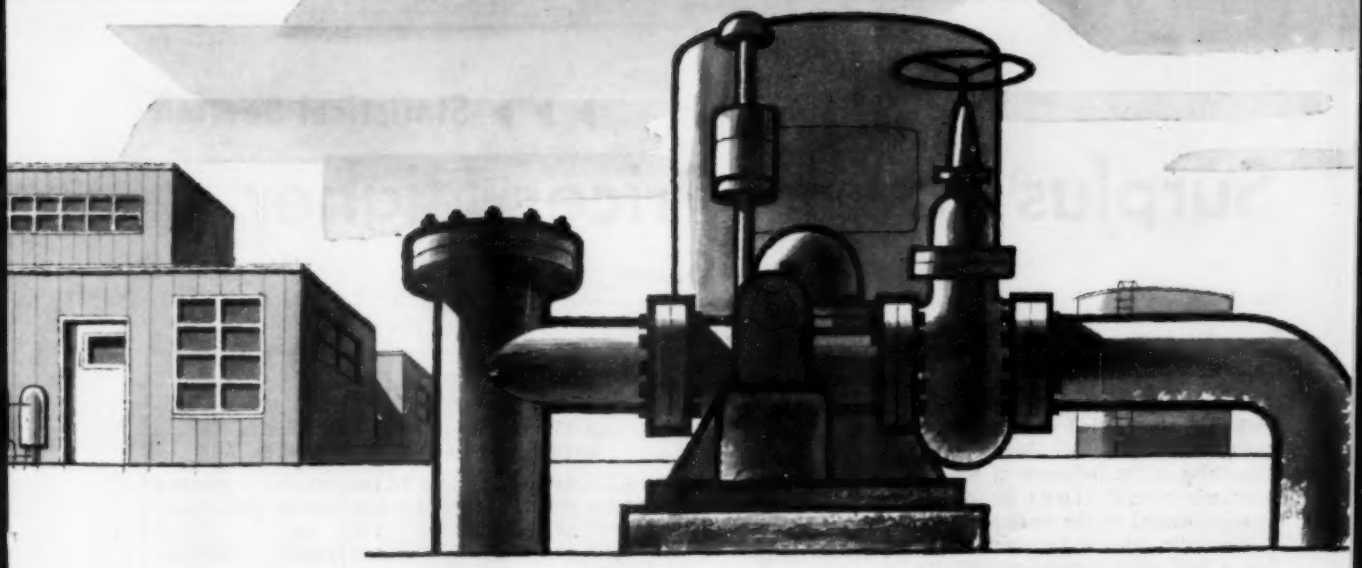
Forrest Box, 61, landman with Pan American Petroleum Corp., died recently in Oklahoma City.

C. Frank Redick, 76, retired production superintendent at Yates field, Texas, for Ohio Oil Co., died recently at his home in Spencerville, Ohio. Redick was named superintendent at Yates field in 1940. He retired in 1945.

J. W. Anderton, one of the former owners of Continental Refining Co., died July 1 in Oil City, Pa. He had been retired since 1933.

William A. Mullane, Jr., 34, engineer for Tennessee Gas Transmission Co. was killed July 4 in an auto accident in Houston.

W. H. Gee, 60, San Antonio, Tex., independent oil man, died recently in a Boulder, Colo., hospital. He had been ill for several months. A graduate of Rice Institute, Gee was one of the discoverers of the second Luling, Tex., oil field.



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Surplus Lower—Prices Higher

BY JOHN C. CASPER
Economics Editor

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from WEEK AGO	
Production	6,379,940	UP	37,240	DOWN	584,735
Crude stocks	258,120,000	DOWN	2,573,000	DOWN	19,163,000
Completions	1,074	UP	139	UP	27
Refinery runs	7,461,000	DOWN	80,000	DOWN	379,000
Gasoline stocks	183,407,700	DOWN	3,079,000	DOWN	2,513,000
Kerosine stocks	24,454,000	UP	599,000	DOWN	4,143,000
Distillate stocks	106,571,000	UP	3,218,000	DOWN	13,021,000
Residual stocks	64,772,000	UP	1,075,000	UP	18,524,000
4-product stocks	379,204,000	UP	1,813,000	DOWN	1,153,000
Total imports	1,679,070	UP	150,070	UP	38,470

DOMESTIC DEMAND for all petroleum showed less than 1% gain in the first half of this year, compared with the same period in 1957. Comparisons in the table below show something of the influence of general economic conditions as well as changes caused by the weather.

Domestic demand for residual fuel has a very close correlation with the FRB Index of Industrial Production. For comparisons that go back of World War II, railroad fuel has to be excluded because of the shift from residual fuel to diesel.

Note on the table that domestic demand for residual fuels in the first half of the year showed a decrease of about 8% from the first half of 1957. Total residual demand was down almost 12% because of the sharp drop in exports. The residual export total for the first half last year was about twice that of a normal year, because of increased shipments during the Suez crisis.

Domestic demand for distillate fuel was up 4.6% but the big decrease in exports brought total demand below last year by 2.3%. A large part of the increase in domestic demand was due to lower average temperatures in the first quarter of 1958.

Gasoline demand was only 48,000 bbl. daily higher than for the first half of 1956 and was 0.2% lower than last year. Export demand was off 35% for a net decrease of 1.2%.

Abnormally high inventories at the first of the year, combined with actual decreases in total demand resulted in low product prices in most of the marketing areas. Production and refinery runs had to be reduced to work off depressing inventories. Since stocks were high and reductions were late getting started, cuts in both production and refinery runs were very severe. Much of the surplus had been used up by the end of June.

Prices are looking up. In some areas, spot prices are up more than formal posted prices. Earlier this year, regular gasoline was available on the Gulf Coast at prices well under the low of formal postings. Today, the market for regular gasoline is considered firm at the low even after the increase of 0.25 cent a gallon in the week following July 4.

Formal gasoline postings on the Gulf Coast have advanced twice since the middle of June. Prices on grades up through 95 octane were raised 0.25 cent in the last week of June. The latest increase also was for 0.25 cent but the range included 97-octane fuel. Motor fuel of 95 octane or less is up 0.5 cent, and 97-octane material is up 0.25 cent on formal postings.

However, spot prices on regular gasoline on the Gulf Coast are higher by at least 0.75 cent a gallon.

Spot-market gasoline in the Mid-Continent also is up at least 0.75 cent a gallon. There have been two increases in formal quotations, and the general overtones of strength indicate the possibility of further gains before the end of the month.

There have been rumors of distillate price increases on the Gulf Coast. This is founded on the fact that distillate will bring more on the spot market today than it would a month ago. No. 2 is strong at 8.125 cents a gallon, at least 0.125 cent higher than it was about the middle of June.

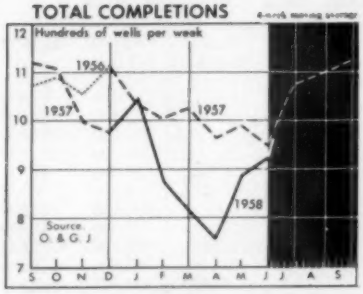
Market reports indicate some reduction in gasoline price wars and a growing tendency on the part of suppliers to take a second look at price-protection policies in price-war areas.

First-half total demand was less than 1956

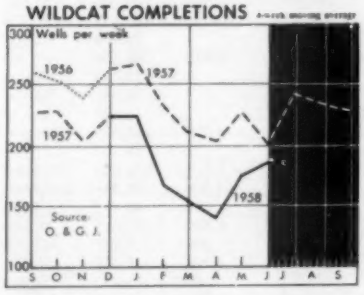
(Thousands of barrels daily)

	1958	1957	1956	1955	1954	1953
Gasoline demand	3,830	3,878	3,791	3,645	3,381	3,345
Domestic	3,755	3,762	3,707	3,557	3,290	3,240
Export	75	116	84	88	91	105
Kerosine demand	343	330	341	325	350	352
Domestic	341	306	335	315	333	329
Export	2	24	16	10	17	23
Distillate demand	1,960	2,007	1,914	1,715	1,587	1,551
Domestic	1,910	1,826	1,851	1,653	1,523	1,449
Export	50	181	63	62	64	102
Residual demand	1,535	1,736	1,699	1,677	1,558	1,682
Domestic	1,480	1,609	1,632	1,575	1,481	1,612
Export	55	127	67	102	77	70
Other demand	1,590	1,759	1,571	1,375	1,227	1,177
Domestic	1,510	1,441	1,418	1,273	1,114	1,044
Crude export	16	243	29	32	40	70
Other export	64	75	124	70	73	63
Total demand	9,258	9,710	9,316	8,737	8,103	8,107
Domestic	8,996	8,944	8,943	8,373	7,741	7,674
Export	262	766	373	364	362	433

TOTAL COMPLETIONS



WILDCAT COMPLETIONS



Active Rotary Rigs*

	7-7-58	6-30-58	7-8-57
Alabama	6	4	7
Arkansas	11	11	21
Arizona	....	....	....
California	77	85	105
Colorado	52	46	50
Florida	1	1	1
Georgia	....	....	....
Idaho	....	....	....
Illinois	46	41	56
Indiana	7	6	8
Iowa	3	3	2
Kansas	127	122	164
Kentucky	11	11	13
Louisiana	302	291	397
North	39	34	51
South	219	214	246
Offshore	44	43	100
Maryland	....	....	....
Michigan	10	8	14
Missouri	1	1	1
Montana	18	21	25
Mississippi	39	35	38
Nebraska	25	20	34
Nevada	....	....	1
New Mexico	122	121	178
New York	2	2	....
North Dakota	34	35	24
Ohio	....	....	1
Oklahoma	204	165	263
Oregon	1	1	....
Pennsylvania	9	9	17
South Dakota	....	....	....
Texas	655	654	992
Gulf Coast	127	131	197
Offshore	5	5	4
West	255	253	372
North	222	220	362
East	46	45	57
Tennessee	....	....	....
Utah	37	36	47
Washington	....	....	1
West Virginia	6	5	4
Wyoming	59	60	77
Virginia	....	....	....
Total U. S.	1,865	1,794	2,541
Western Canada	134	148	221
Eastern Canada	3	3	1
Grand total	2,002	1,945	2,763

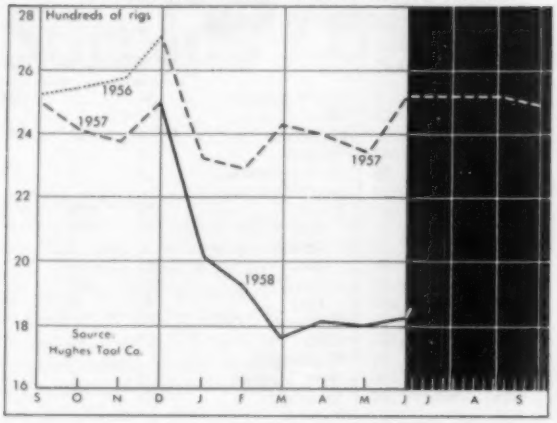
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JULY 5, 1958

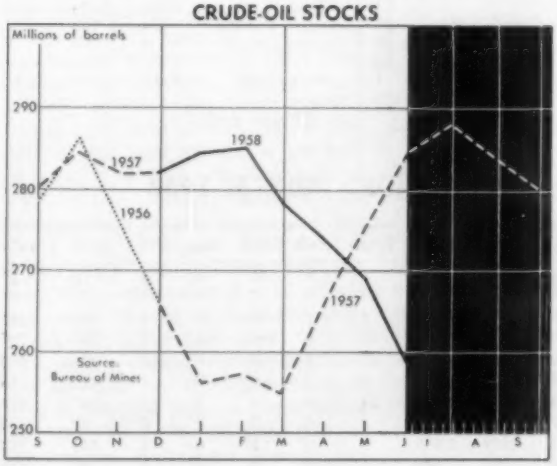
	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1958	1957	Total	Crude	Cond.	Gas	Dry	1958	1957
Alabama	0	0	0	0	0	0	0	41	58	0	0	0	0	0	16	21
Arkansas	17	5	0	3	9	0	74,056	336	529	4	0	0	1	3	86	97
California	20	13	0	1	6	0	95,546	870	1,072	5	1	0	0	4	179	261
Colorado	18	1	0	1	16	0	95,478	382	434	13	0	0	0	13	209	295
Illinois	65	26	0	3	39	0	159,980	1,023	1,235	11	1	0	0	10	206	305
Indiana	26	13	0	0	13	0	46,365	358	311	6	2	0	0	4	135	64
Kansas	106	60	0	1	41	4	356,748	1,879	2,104	21	5	0	1	15	391	416
Kentucky	42	21	0	7	14	0	54,001	512	698	9	4	0	1	4	59	138
Louisiana	58	28	5	9	16	0	458,217	1,699	1,929	5	0	1	0	4	245	352
North	19	5	0	8	6	0	58,456	592	646	1	0	0	0	1	84	84
South	34	19	4	1	10	0	341,487	880	912	4	0	1	0	3	145	222
Offshore	5	4	1	0	0	0	58,274	227	371	0	0	0	0	0	16	46
Michigan	13	3	0	0	7	3	31,578	197	200	6	1	0	0	5	69	83
Mississippi	10	4	1	0	5	0	99,660	198	189	4	1	1	0	2	99	96
Montana	1	1	0	0	0	0	9,056	184	187	0	0	0	0	0	81	65
Nebraska	23	6	0	0	17	0	137,220	350	412	17	2	0	0	15	168	234
New Mexico	51	23	1	20	7	0	247,629	979	1,067	3	0	1	0	2	125	142
West	30	6	1	20	3	0	128,023	460	399	2	0	1	0	1	54	50
East	21	17	0	0	4	0	119,606	519	668	1	0	0	0	1	71	92
New York	10	5	0	0	0	5	13,500	294	230	0	0	0	0	0	31	1
North Dakota	5	1	0	0	4	0	33,940	216	141	2	0	0	0	2	71	56
Ohio	0	0	0	0	0	0	0	512	547	0	0	0	0	0	5	5
Oklahoma	156	84	1	6	59	6	460,522	3,341	3,158	29	6	0	1	22	467	361
Pennsylvania	73	20	0	27	7	19	191,926	310	353	2	0	0	0	2	9	35
Texas	353	186	12	26	122	7	1,442,966	9,206	11,097	74	6	0	1	67	1,894	2,782
District 1	23	8	1	1	13	0	58,314	517	647	9	0	0	0	9	209	218
District 2	9	2	1	2	4	0	67,535	395	364	4	0	0	1	3	103	140
District 3	29	10	3	1	13	2	194,493	675	943	6	0	0	0	6	140	276
District 4	35	8	3	3	21	0	174,490	632	733	12	2	0	0	10	185	256
East	21	13	0	0	8	0	106,253	619	643	7	1	0	0	6	178	197
District 7-B	53	33	0	0	20	0	130,403	1,210	1,426	14	2	0	0	12	339	531
West	87	63	1	3	20	0	411,212	2,707	3,171	12	0	0	0	12	381	471
District 9	65	39	0	3	18	5	164,897	1,810	2,456	8	1	0	0	7	306	643
District 10	31	10	3	13	5	0	135,369	641	714	2	0	0	0	2	53	50
Utah	8	5	0	1	2	0	41,842	211	99	1	0	0	1	0	38	56
West Virginia	7	3	0	4	0	0	18,487	346	311	0	0	0	0	0	10	14
Wyoming	11	6	0	0	5	0	47,781	358	412	3	0	0	0	3	102	137
Misc. (Ariz.)	1	0	0	0	1	0	1,683	52	35	1	0	0	0	1	44	27
Total U. S.	1,074	514	20	106	390	44	4,118,181	23,854	26,808	216	29	3	6	178	4,739	6,043
Prev. week	935	462	24	50	376	23	3,856,549	.....	.....	183	20	1	7	155	.....	.....
Cum. 1958	23,854	11,775	584	1,797	9,115	583	100,165,842	.....	.....	4,739	460	77	148	4,054	.....	.....
Western Canada	73	45	0	13	14	1	344,830	1,221	1,513	11	3	0	1	7	387	413

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



DAILY AVERAGE PRODUCTION FOR WEEK

	July 5, 1958 Crude oil	Lease condensate	Total	June 28 total
Alabama	17,700	.....	17,700	17,650
Arkansas	74,875	225	75,100	74,900
California	849,200	.....	849,200	850,300
Colorado	132,000	.....	132,000	131,800
Eastern	47,200	.....	47,200	47,500
Florida	1,200	.....	1,200	1,275
Illinois	231,600	.....	231,600	228,500
Indiana	31,000	.....	31,000	31,600
Kansas	313,290	.....	313,290	†322,650
Kentucky	43,300	.....	43,300	43,200
Louisiana	728,875	82,800	811,675	814,325
North	106,300	2,800	109,100	112,550
South	622,575	80,000	702,575	701,775
Michigan	24,600	.....	24,600	24,300
Mississippi	94,225	3,975	98,200	97,700
Montana	78,400	.....	78,400	77,900
Nebraska	54,000	.....	54,000	53,500
Nevada	100	.....	100	100
New Mexico	261,375	5,200	266,575	276,800
North Dakota	38,100	.....	38,100	37,300
Oklahoma	†534,400	.....	†534,400	†523,000
Texas	2,283,850	63,100	2,346,950	2,270,000
Dist. 1	44,075	400	44,475	45,900
Dist. 2	93,425	8,600	102,025	98,600
Dist. 3	321,850	31,000	352,850	347,000
Dist. 4	169,850	8,200	178,050	171,200
Dist. 5	25,775	300	26,075	25,800
Dist. 6	96,575	6,200	102,775	99,000
East Texas field	125,150	.....	125,150	120,000
Dist. 7-B	123,725	100	123,825	122,100
Dist. 7-C	199,850	4,150	204,000	121,050
Dist. 8	871,275	1,900	873,175	818,900
Dist. 9	188,000	1,600	189,600	193,800
Dist. 10	104,300	650	104,950	106,650
Utah	90,000	.....	90,000	130,000
Wyoming	295,200	.....	295,200	288,250
Others	‡150	.....	‡150	‡150
Total U. S.	6,224,640	155,300	**6,379,940**	6,342,700
Change from previous week, up		.....	**37,240**	
Canada	†400,100	.....	†400,100	†431,600

Total U. S. production, January 1-July 5 ..... 1,200,916,700 bbl.
Same period last year (crude plus cond.) ..... *1,391,234,700 bbl.

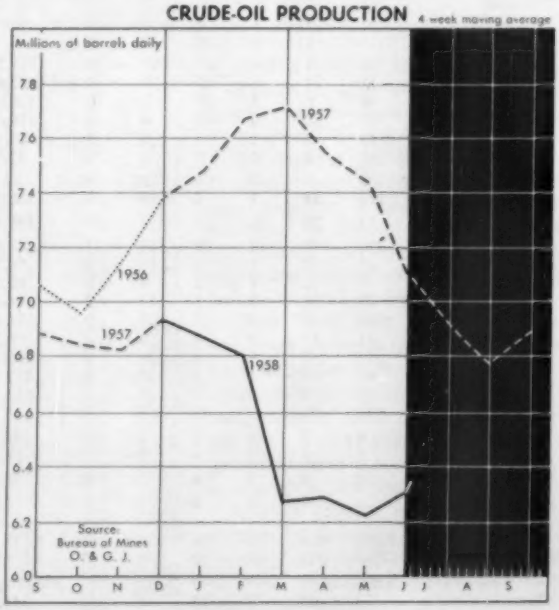
*Includes 26,334,525 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

CRUDE-OIL STOCKS BY STATES OF ORIGIN*
(Thousands of barrels)

	6-28-58	6-21-58	6-29-57
Pennsylvania	2,887	2,904	2,812
Other Appalachian	1,358	1,601	1,749
Illinois, Indiana, and Michigan	11,334	11,262	9,858
Nebraska and North Dakota	2,096	2,147	2,568
Kansas	10,345	10,349	10,896
Oklahoma	17,024	16,665	21,700
Arkansas	2,323	2,322	2,748
Louisiana	16,030	16,871	18,249
North	2,867	2,897	2,727
South	13,163	13,974	15,522
Mississippi, Alabama, and Florida	2,050	2,030	3,110
New Mexico	6,529	7,083	7,615
Texas	106,623	108,208	128,858
East Texas	7,385	7,620	11,613
West Texas	50,292	51,281	60,555
Texas Gulf	21,189	21,102	24,579
Other Texas	27,757	28,205	32,111
Wyoming	15,863	15,101	17,868
Other Rocky Mountain	8,248	8,151	6,030
California	39,438	39,099	27,702
Foreign	†15,972	16,900	15,520
Total	**275,534**	279,290	259,685

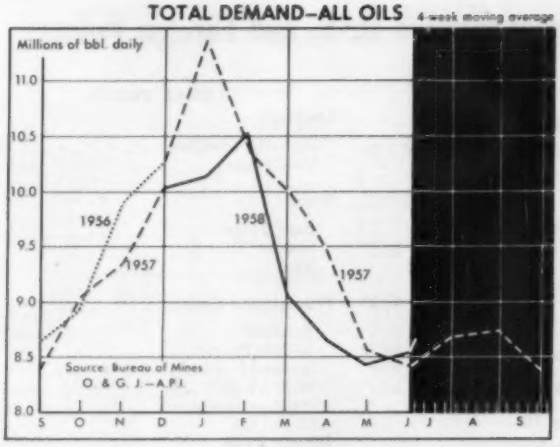
*Bureau of Mines. †Includes 5,340,000 bbl. in California.

CRUDE-OIL PRODUCTION 4 week moving average

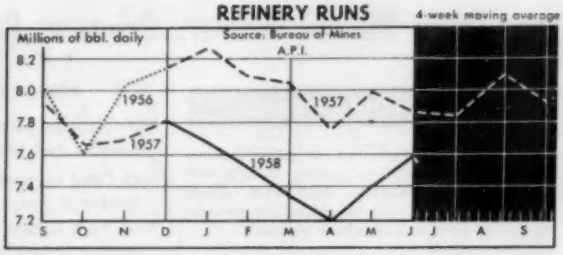


REFINING

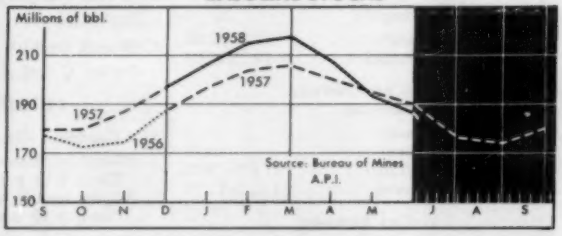
TOTAL DEMAND—ALL OILS 4-week moving average



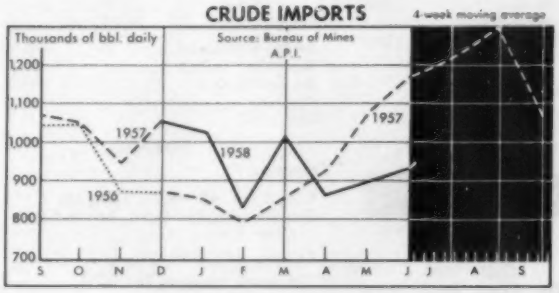
REFINERY RUNS 4-week moving average



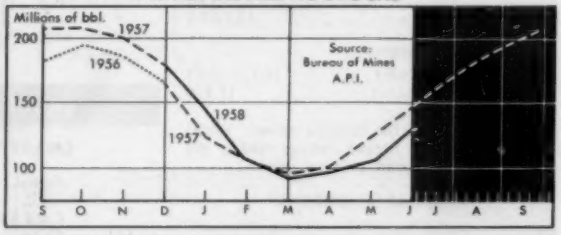
GASOLINE STOCKS



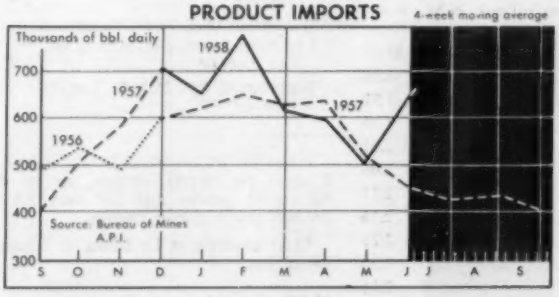
CRUDE IMPORTS 4-week moving average



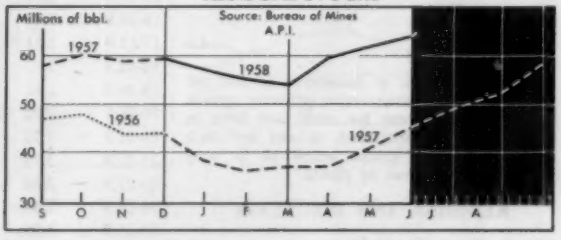
MIDDLE-DISTILLATE STOCKS



PRODUCT IMPORTS 4-week moving average



RESIDUAL STOCKS



API REFINERY REPORT—JULY 4, 1958
(Thousands of barrels)

District—	Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.	Stocks‡: Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, July 1957: Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.
East Coast	1,065	516.7	20.2	263.0	208.6	43,364	9,469	34,833	13,394	1,235	483.3	30.8	322.6	229.2
Appalachian:														
Dist. 1	101	48.0	3.3	21.6	4.1	4,747	525	2,281	572	102	45.3	2.5	22.3	4.8
Dist. 2	106	55.7	6.4	16.8	7.8	2,552	514	1,061	305	48	26.8	2.4	6.8	7.1
Ind., Ill. Ky.	1,383	734.4	69.0	264.8	143.1	34,021	5,315	18,005	5,223	1,271	662.9	53.8	254.2	139.9
Minn., Wis., Dak.	109	53.3	6.7	27.0	11.0	7,182	1,238	5,478	601	104	48.7	5.6	30.2	8.2
Okla., Kans., Mo.	765	423.7	9.7	184.7	27.3	16,218	1,356	10,001	948	728	405.0	11.8	160.3	28.1
Inland Texas	283	202.6	7.7	48.9	18.0	6,615	297	1,588	2,094	278	212.3	8.5	49.6	20.6
Tex. Gulf Coast	1,613	821.7	74.7	365.7	187.0	22,106	2,716	10,470	6,586	1,854	904.1	77.6	471.7	241.6
La. Gulf Coast	585	395.0	48.0	159.9	37.0	9,413	1,532	4,817	1,560	668	361.1	45.5	169.0	45.3
N. La. and Ark.	99	33.7	4.7	23.0	6.6	4,501	806	1,987	151	97	34.7	5.6	22.4	6.7
Rocky Mountain:														
New Mexico	20	8.6	1.2	4.6	3.0	611	26	142	67	26	13.7	0.1	6.2	2.3
Other Rky. Mt.	302	133.0	5.1	59.0	36.0	6,252	262	2,843	967	285	134.1	2.1	61.4	34.6
West Coast	1,030	471.0	4.9	150.7	270.9	25,815	398	13,065	32,304	1,156	500.5	2.7	172.9	321.2
July 4, 1958	7,461	3,897.4	261.6	1,589.7	960.4	183,407	24,454	106,571	64,772	7,852	3,832.5	249.0	1,749.6	1,089.6
June 27, 1958	7,541	3,865.9	235.6	1,604.1	946.4	186,486	23,855	103,353	63,697	.....	.....	.....	.....	.....
July 5, 1957	7,840	3,696.6	249.0	1,778.0	1,104.3	185,920	28,597	119,592	46,248	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	11.75-12.00
Premium (99 octane)	14.75-15.00
Gulf Coast (cargoes for coastwise or export movements):	
★ Regular (90 octane)	10.5
★ Regular (92 octane)	10.75
★ Premium (97 octane)	11.875-12.00
Premium (98 octane)	12.125-12.75
California (rack) (Los Angeles):	
Regular (88 octane)	11.3-11.5
Premium (96 octane)	12.8-13.0
Premium (98 octane)	13.3-13.5
Caribbean area (cargoes):	
★ Regular (87 octane)	10.125-10.25
★ Premium (97 octane)	11.875

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.25-9.50
Diesel oil (58 d.i. and above)	8.875-9.125
Distillate No. 1	8.875-9.125
Distillate No. 2	8.25-8.50
Gulf Coast (cargoes):	
Kerosine 41-43	8.50-8.75
Distillate No. 2	8.125-8.25
New York Harbor (barges):	
Kerosine 41-43	9.35
Distillate No. 2	8.85
Diesel fuel, 48-52 d.i.	9.45
Caribbean area (cargoes):	
Distillate No. 2	8.125

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max 1% S)	$1.25-1.30
Gulf Coast (cargoes):	
Bunker C fuel	$2.20-2.25
New York Harbor (barges):	
Bunker C fuel	$2.57
Caribbean (cargoes):	
Bunker C	$2.25
California (rack):	
Bunker C fuel, Los Angeles	$2.45

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.5
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.§	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.36	....	....	....	....
15-15.9	2.41	....	....	....	$1.81
16-16.9	2.46	....	....	....	1.86
17-17.9	2.51	....	....	....	1.91
18-18.9	2.57	....	....	....	1.96
19-19.9	2.62	....	....	....	2.01
20-20.9	2.68	$2.75	....	$2.62	2.06
21-21.9	2.73	2.77	....	2.64	2.11
22-22.9	2.78	2.79	....	2.66	2.16
23-23.9	2.84	2.81	$3.44	2.68	2.21
24-24.9	2.89	2.83	3.46	2.70	2.26
25-25.9	2.95	2.85	3.48	2.72	2.31
26-26.9	3.00	2.87	3.50	2.74	2.36
27-27.9	3.06	2.89	3.52	2.76	2.49
28-28.9	3.11	2.91	3.54	2.78	2.54
29-29.9	3.16	2.93	3.56	2.80	2.59
30-30.9	3.22	2.95	....	2.82	2.63
31-31.9	3.27	2.97	....	2.84	2.67
32-32.9	3.33	2.99	....	2.86	2.71
33-33.9	3.38	3.01	....	2.88	2.75
34-34.9	3.44	3.03	....	2.90	2.79
35-35.9	....	3.05	....	2.92	2.83
36-36.9	....	3.07	....	2.94	2.87
37-37.9	....	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma (sweet), part of Kansas, North Dakota, W. Texas (sweet). Some Oklahoma available for 15 cents less starting 3-17-58 and other at 10 cents less on 4-1-58. †Low cold test crude. ‡Sour. §Some postings 3-11 cents lower.

Effective dates of broad changes: California, 6-22-58; east of California, January 3-10, 1957; Pennsylvania Grade 6-18-58.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	3.90
Middle District	3.72
Southwest Pennsylvania	3.43
West Virginia	3.25
Buckeye Grade	3.25
Illinois Basin	3.00
Canada:	
Leduc-Woodbend	2.67
Redwater (Alta.)	2.56
Smiley (Sask.)	2.33
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26°-26.9°, Amuay*	2.55
Quiriquire, 16.0°-16.4°, Caripito	2.30
Lagunillas heavy, flat, Amuay or Las Piedras*	2.25
Bachaquero, flat, 15°-16°, Las Piedras*	2.08

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 35.0°-35.9°, Fao	1.98
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0-41.9°, Umm Said	2.23
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.49
Iraq, 36.0°-36.9°, Tripoli, Banias	2.49
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Carib.-U.K., clean (Scale—31.25%) (22s. 4d.)	$3.13
★ Carib.-UK, dirty (Scale—55%) (14s. 8d.)	2.05
Gulf-U.S.N.H., clean (USMC—27.5%)	2.07
Gulf-U.S.N.H., dirty (USMC—35%)	1.85

SELECTED MONTHLY DATA

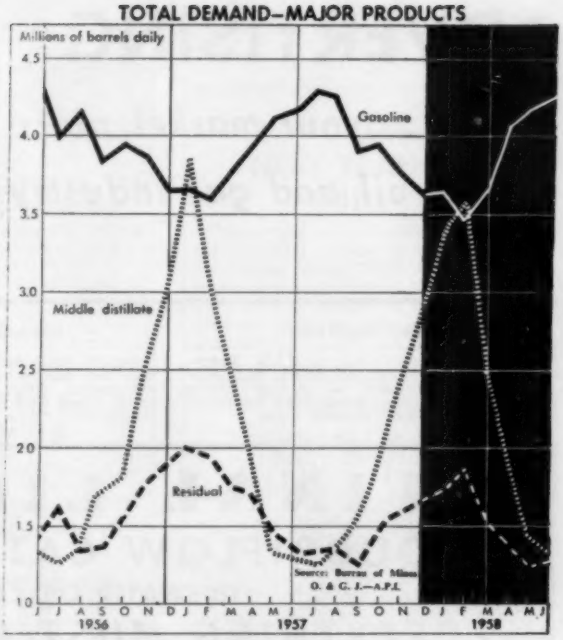
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

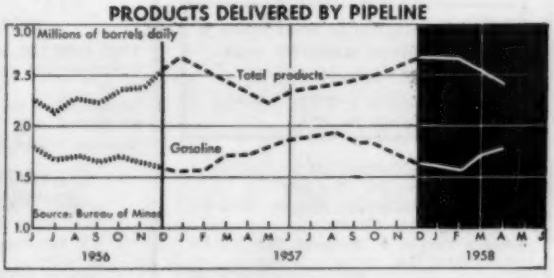
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
June 1958*	4,243	3,864	182,700
May 1958*	4,130	3,672	193,200
April 1958	4,021	3,559	206,340
July 1957	4,286	3,832	177,868
June 1957	4,156	3,881	190,063
KEROSINE			
June 1958*	172	255	23,500
May 1958*	141	240	21,700
April 1958	205	270	18,729
July 1957	162	249	31,713
June 1957	141	254	28,872
DISTILLATE			
June 1958*	1,162	1,642	105,150
May 1958*	1,288	1,664	86,000
April 1958	1,559	1,568	76,239
July 1957	1,095	1,750	138,359
June 1957	1,112	1,773	117,364
RESIDUAL			
June 1958*	1,286	945	64,300
May 1958*	1,261	953	60,800
April 1958	1,347	947	57,975
July 1957	1,362	1,100	49,621
June 1957	1,387	1,101	45,572

*Preliminary. †Thousands of barrels.

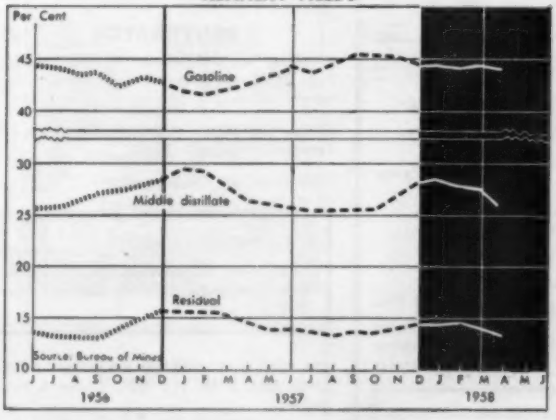
TOTAL DEMAND–MAJOR PRODUCTS



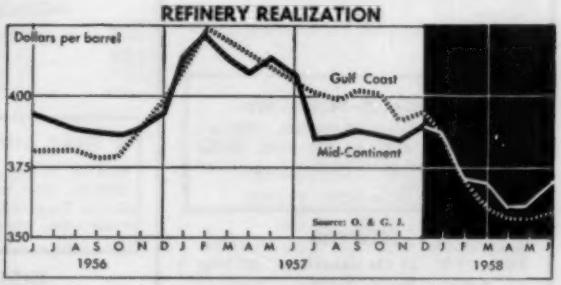
PRODUCTS DELIVERED BY PIPELINE



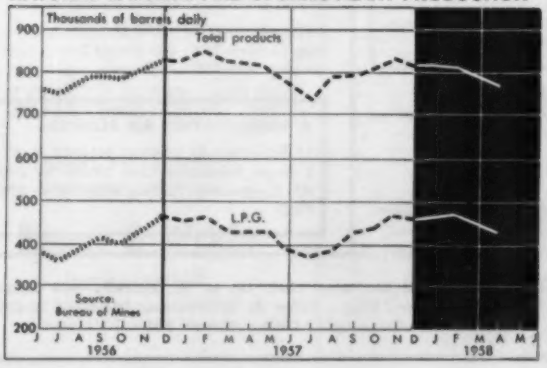
REFINERY YIELDS



REFINERY REALIZATION



NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



REFINERY REALIZATION

	June* 1958	May* 1958	April 1958	June 1957
Mid-Continent	$3.71	$3.61	$3.58	$4.08
Gulf Coast	3.60	3.58	3.55	4.06

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

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SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

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1 36L BUCYRUS Spudder complete with 5 and 7 inch tailing in tools. Dog house, butane tank, junk rack and light plant. Rod and tubing tools and hand tools. Phone Office 144, Res. 614, Cleveland, Oklahoma.

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TREMENDOUS SAVINGS—EQUIPMENT PRICED FOR QUICK SALE

MAJOR UNITS

★ DEETHANIZER—DEPENTHANIZER ★
DEBUTANIZER—GIRBOTOL UNIT
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Will be sold as complete Units or Piece by Piece

KILN 18'-6½" ID x 55'8" OA
Fines Storage Bin 6'0" ID x 10'6"
Catalyst Lift Disengaging Hopper, 12' & 5'6" ID x 51' OA—5% Chrome.
Catalyst Storage & Shutdown Hopper 12'6" ID x 160'11" OA.
Drums & Receivers: 8'0" x 28'9"; 5' x 14'; 4' x 12'
Fines Separators, Centrifix 16" type RVD
Fresh Catalyst Elevator, 72' cc, 8" x 5" Buckets
Barometric Condenser, Elliott #06HB, 8500# Steam/hr.

★ OIL PREHEATER—PETRO-CHEM—
Iso-Flow Furnace 19,000,000 BTU/hr., Inlet Temp., 447° F., 200 PSIG, Outlet Temp. 670° F., 135 PSIG, Charge Gas/Oil 106,294 lbs./hr.

TOWERS

8'0" x 75'0"	25 PSI Monel lined	22 Trays
6'0" x 30'0"	50 PSI	9 Trays
5'0" x 58'0"	50 PSI	26 Trays
3'0" x 45'0"	260 PSI Packed	
3'0" x 32'0"	40 PSI	8 Stainless Trays
3'0" x 23'6"	600 PSI Packed	
2'6" x 77'6"	275 PSI	32 Stainless Trays
2'6" x 43'6"	180 PSI	24 Trays
2'6" x 30'0"	270 PSI Packed	

HEAT EXCHANGERS—CONDENSERS

STEEL TUBE 170, 880, 1080
CUPRO-NICKEL Monel Clad Shell 1495 Sq. Ft. (2)
BROWN FINTUBE, Steel Shells & Tubes 600 PSI 600° F. (24) 101 to 141 Sq. Ft.
Reboilers U-Tube Bundles, 220; 165 Sq. Ft.

BYRON JACKSON CENTRIFUGAL PUMPS

Motor & Turbine Driven
1½" x 2" Two Stage 1½" x 2½" Two Stage
2" x 3" 3" x 4" 4" x 6"
DUPLEX & SIMPLEX STEAM PUMPS
4½ x 4 x 6 up to 12 x 5 x 12
HOT OIL 6 x 4 x 6

POMONA PUMPS

GPM	PRESSURE	DRIVE
2600	75 PSI	200 HP Motor
1550	75 PSI	125 HP Motor
680	65 PSI	40 HP Motor

★ STEAM GENERATOR—PETRO-CHEM
Iso-Flow Furnace—Two Pass 25 Million BTU/hr., Inlet temp. 412° F., 375 PSIG, Outlet Temp. 420° F., 315 PSIG, Charge: Feed Water 289 GPM.

INSTRUMENTS

Complete instrumentation for control of all steps in process—Write for complete list.

CROLOY-5

New & Used Furnace Tubes—Write for List
LARGE TONNAGE of Steel Pipe, Flanges, Fittings, Valves

PASSENGER ELEVATOR

Otis Electric 6' x 6', Travel 182'6" 10 Opening stops same side. Rate of Travel 300 FPM, Capacity 2500 lbs.

DEHYDRATOR

Propane Gas Dehydrator, 20,000 gal./day, Type EXHC—SX Anders Fully Automatic dual tower.

ETHYL BLENDING PLANT, 8,500 gallon—60 Ton Howe Weight-O-Graph

HARDINGE API Oil Separator

★ AIR HEATER—PEABODY—
Direct Fired API-ASME—Capacity 10,000 SCFM Inlet temp. 100° F., Outlet Temp. 1200° F.

125 KW GAS ENGINE GENERATOR SET, 2300 Volts, 3/60/514 RPM, Exciter & Panel Board.

LARGE QUANTITY of Explosion Proof Motors, Electric Starters & Fittings.

AUTOMATIC TELEPHONE EQUIPMENT, Kellogg Cordless PBX—100 Circuit Switch Board, complete with 100 Telephones.

★ REGENERATION AIR BLOWER—
11,000 CFM—@ 11 PSIG ELLIOTT #45—2 Stage Meehanite Case Driven by 600 HP Condensing Turbine 6200 RPM 290 PSIG.

HEAT & POWER CO., INC.

60 East 42nd St., New York 17, N. Y., MUrray Hill 7-5280
310 Thompson Bldg., Tulsa 3, Oklahoma, Diamond 3-4890
SITE OFFICE—Drumright, Okla., Phone 569

FOR SALE EQUIPMENT

HYDRAULIC CASING pulling business. 2 complete units, each with 2 trucks, pick-up, tools & rippers. Units mounted on trucks. In operation. 25 well contracts goes with business. Only hydraulic casing pulling units in this area. Office & storage building available if desired. Jamison Pipe & Tool Co. Phone 80, Madison, Kansas.

FOR SALE: Model "D" Fort Worth Spudder, complete with tools. Excellent condition. Reasonably priced. Box K-777, The Oil and Gas Journal, Tulsa, Oklahoma.

ROTARY DRILLER TANDEM MTD.: 2 Trucks and equipment, $8500.00. Located Roy, N. M. 2000' capacity. Liquidation sale. Details write Stumpff & Owen, P. O. Box 278, Aurora 8, Colorado.

NEW 7-IN. OD J-55 Seamless casing. Mill test 3,000 lb., 8 round thread. $1.65 and up F.O.B. Houston and Alice. Bellaire Pipe & Supply, 8020 Lyons Avenue, Houston, phone ORchard 4-2763.

1956 FAILING 1500 HD, equipped. Excellent condition. Additional drilling equipment. Richard Travis, Box 1347, CHapel 2-8331, Grand Junction, Colorado.

COMPRESSORS and Heat Exchangers. Some New, Some Used. Also Compressor Cylinders for Clark, Worthington, Ingersoll-Rand. Up to 20 inch diameter. Try us. We can likely serve you well. Bell Engineering Sales Inc. P. O. Box 1178, Shreveport.

NEW LINE PIPE FOR SALE

40,000'— 8⅝" OD .188 Wall Electric Resistance Weld
14,000'—12¾" OD .250 Wall Electric Resistance Weld
All pipe fully mill tested in accordance with API specifications.
Attractively priced for quick sale.

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13,000 Ft. 18" OD
⅜" Wall, Plain End
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Used Line Pipe

PRICED ATTRACTIVELY
INQUIRIES WELCOME

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Incorporated
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CHARLESTON 26, W. VA.

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MATHEY Compression test unit mounted in 1957 air conditioned Buick—charcoal meter—no balance or ranarex. Rutter and Wilbanks Brothers, 500 North Big Spring Street, Midland, Texas.

CLARK MODEL HMA-4 gas engine driven skid mounted (packaged) compressor with 175 HP, two stage, 3½" and 2⅝" by 8¼" compressor cylinders, 400 PSI suction, 2900 PSI discharge, 50,000 SCFH, unused, contact Demse, Lowell Gas Co., Lowell, Massachusetts.

8⅝" 28 LB. LAPWELD line pipe, 600,000 ft. No. 1 grade. Indiana-Ohio Pipe Co. P. O. Box 323. Phone 3-4674, Decatur, Indiana.

FAILING—Rotary Rig—Capacity 2500 Ft. 2900 Ft. 2⅞ in. x 30 ft. drill pipe, top grade with new tool joints. Gardner-Denver Pump 5 x 10 skid-mounted, 3—30 ft. drill collars. Hughes core barrel. This rig too large for our needs. Price $20,000. Would consider top grade 1500 ft. at actual value—balance—cash. Hobert Betz—Lane, Kansas—Phone 39.

NAT. 130 DRILLING RIG FOR IMMEDIATE SALE IN COLOMBIA

One complete Nat. 130 rig, with all normal auxiliary components. Six years old and has drilled total 118,000 ft.
Rig is in sound operating condition. Sale will be made by bid only. All inquiries and replies should be addressed to:

General Manager
INTERNATIONAL PETROLEUM (COLOMBIA) LTD.
Apartado Aéreo No. 3533
BOGOTA, COLOMBIA, S.A.
(Telephone: 437-400)

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WANTED: Good Used Double-Drum Truck Mounted Well Servicing Unit, capable of servicing to 10,000 feet. Box K-751, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED TO BUY—Used two-way radio system complete with base station, tower and units for rigs, cars, and trucks. Advise location and price. Box K-765, The Oil and Gas Journal, Tulsa, Oklahoma.

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Good Used or New Surplus
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2"—2½"—3"—4"
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Phone HArrison 1-1000

WANTED—Complete Portable Rotary used Mayhew or Failing rig with drill pipe and tools, suitable for drilling to two thousand feet. State full particulars and price. F. F. Ravlin, 1300 Alfonso Ave. Coral Gables, Florida.

HELP WANTED

FOREIGN EMPLOYMENT. List oil companies, drilling contractors, seismograph contractors, showing where apply foreign jobs, $5.00 cash. OIML Co., Box 2003, Tulsa, Okla.

ELECTRICAL ENGINEER: Graduate electrical engineer for natural-gasoline-plant and compressor-station design. Experience in industrial-wiring design and layout desirable. Dresser Engineering Co., Masonic Bldg., Tulsa, Oklahoma.

MECHANICAL ENGINEER—Cabot Shops, Inc., Pampa, Texas, has immediate opening for Mechanical Engineer with degree and design experience in oilfield drilling and servicing equipment or pumping units. Work involves design of mechanical and structural components, including machine design, stress analysis, pneumatics, hydraulics and power transmission. Resume and details should be addressed: Mr. Bill Kelley, Personnel Department, Cabot Shops, Inc., P. O. Box 1101, Pampa, Texas.

HELP WANTED

LARGE AGGRESSIVE COMPANY desires Geologist with Gulf Coast experience to work in Houston. Send detailed resume, snapshot, and salary requirements to Box K-741, The Oil and Gas Journal, Tulsa, Oklahoma.

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HEAT TRANSFER PRODUCTS

Major and well established manufacturer of heat transfer products, serving the engine and oil field industries, has outstanding opportunity for sales manager or well established manufacturer's representative for right man with engineering background in Mid-Continent area. Give record and references. Replies will be treated confidentially.

Box K-736,
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ACTIVE INDEPENDENT organization has position for an experienced graduate engineer. Position will require extensive production and completion work, as well as an understanding of secondary projects. Include educational and professional history. All replies confidential. Box K-768, The Oil and Gas Journal, Tulsa, Oklahoma.

GASOLINE PLANT-Compressor Station superintendent. Experience is important. Salary commensurate with experience. Central Oklahoma. Send resume to: Box K-759, The Oil and Gas Journal, Tulsa, Oklahoma.

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PERSONNEL MANAGER
ETHYL CORPORATION
1600 W. 8 MILE ROAD
FERNDALE 20, DETROIT, MICHIGAN

SITUATION WANTED

GEOLOGICAL ENGINEER: 31; experience with major and independent. Desire work in production, drilling and/or geology; domestic or foreign. James C. Allison, Kittanning, Penna. Phone LI 2-4861.

GEOLOGIST, 32, M.S. Caltech, special studies in sedimentation, wants position as petroleum geologist. Eight years varied domestic engineering experience with major company in development drilling operations, property evaluations, subsurface studies. Box 31 J 282, The Oil and Gas Journal, 4041 Marlton Ave., L.A. 8, Calif.

SITUATION WANTED

PETROLEUM GEOLOGIST, Masters degree, 10 years diversified exploration experience in Mississippi, Alabama, and Louisiana desires retainer or connection with company, independent or investment group. Box 6657, Jackson, Miss.

GEOLOGIST with Land Experience—Major company exploration geological experience Texas-Louisiana-Arkansas Gulf Coast, Mississippi, Alabama, Florida. Considerable experience Landman and practicing Attorney. Desires connection small company or independent. Box K-778, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST, BS & BA, 48, 21 years experience seismic and well logging, last 11 years seismic interpretation. Desires connection with aggressive independent. Well qualified to supervise current work and reanalyze previous surveys. E. L. Stacy, Box 371, San Angelo, Texas. Ph. 2-6226.

ACCOUNTANT, BBA, 33, 6 years experience production companies, all phases, tax background. Box 31 J 284, The Oil and Gas Journal, 4041 Marlton Ave., L. A. 8, Calif.

GEOLOGIST, MS. Considerable major company experience. Have complete geological office with all available information on OHIO, ILLINOIS, INDIANA and KENTUCKY. Interested in joining an aggressive independent particularly for OHIO. Part time or full time. Box K-770, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, MS. Former major company division geologist with considerable subsurface experience. Have administrative and executive ability. Desires foreign or Alaska contract. Box K-771, The Oil and Gas Journal, Tulsa, Oklahoma.

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CHEMICAL-INDUSTRIAL ENGINEER—Advisor and Consultant on Executive and Administrative level. Operation, liaison, process development, process improvement, new ideas and methods and application to full scale operation. VERY PRACTICAL. M.I.T. 1925—Age 52. Accustomed to work with new developments on basis of Salary and Bonus. Experience includes, oil refining, gas, Carbon Dioxide recovery and purification, Dry Ice manufacture, lube oil, wax, and asphalt manufacture, etc. Member A.I.Ch.E., A.C.S., A.S.R.E.
Box K-766, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED—RESPONSIBILITY

Well rounded experience in oil business. Operating manager of small foreign refinery. Registered professional engineer. Experienced in purchasing, sales, refinery design. Desires executive or administrative position with oil company or related industry. Eager to assume heavy responsibility. Reply:

Box K-776,
The Oil and Gas Journal,
Tulsa, Oklahoma.

SITUATION WANTED

CHEMICAL ENGINEER. Now on active duty with armed forces. Desires position with growing company in Mid or Far West areas. References. Box K-772, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER: 27 years experience including 15 years top level management of refinery operations and maintenance covering both F.C.C. and T.C.C. units and their associated units. Having just completed South American assignment, desire responsible position in U.S.A. Box K-773, The Oil and Gas Journal, Tulsa, Oklahoma.

OFFICE MANAGER or Administrative assistant: 33, background in accounting (BBA degree). One year graduate work. Three years experience, pipeline superintendent; three years general office, administrative. Excellent references. Available immediately. Robert Sanders, 1007 South 7th, Chickasha, Okla.

SCOUTING

THE ALASKA OIL SCOUT—"Your personal Alaska landman." Complete research & filing service. Status Reports—Maps—Information. 1702-J Twining Avenue, Anchorage, Alaska.

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FOR SALE—130,000 acre stock ranch in the San Luis Valley in Colorado, including livestock and equipment—$4,000,000.00. Clifford Burnham, Real Estate, Saguache, Colorado.

LEASE AND DRILLING BLOCKS

FOR SALE: 1/16 or 1/8 over-riding royalty on 400 acres, Survey No. 30, Scleicher County, Texas. Offsetting discovery well that is flowing 300 bbl. natural. Write: R. R. #2, Box 19B, Okmulgee, Oklahoma.

PRINCIPALS with unlimited funds seek any-sized oil-gas production. Give details; strict confidence. Box K-774, The Oil and Gas Journal, Tulsa, Oklahoma.

19,000 ACRES LEASES in Devonian Trend Ky. that has produced 100 million bbls. oil—1,000 ft. Give evidence ability. 50c acre. Box K-767, The Oil and Gas Journal, Tulsa, Oklahoma.

5000 ACRE BLOCK in Muskingum County, Ohio. Two good showings of oil & gas in old wells, Clinton Sand. Virgin territory. Will farm out, or have interest carried. Write P. O. Box #81, Cambridge, Ohio.

WE OWN, and offer for immediate sale, approximately 9300 acres of federal leases in Mesa County, Colorado, located in Townships 8, 9, and 10 South, Ranges 101 through 103. Elkhorn Oil Company, 1327 Speer Blvd., Denver, Colorado. Phone AComa 2-7885.

FOR SALE: Working interest for only $375 per 1/8 to drill shallow Dutcher-Pitkin lime well on 160 or 80 acre leases with perfect geology. Your choice on either lease or both. Details write, L. Snavely, P. O. Box 315, Coweta, Okla.

ELECTRIC LOG CABINETS

FOR ECONOMICAL FILING of full-size electric logs, most geologists prefer Kraftbuilt E-24 4-drawer cabinet. Two compartments to each drawer with separate follow blocks make this cabinet handy, economical. For filing reduced electric logs, geologists use Kraftbilt E-28 8-drawer cabinet. Send for catalog 58-B. Ross-Martin Co., P. O. Box 400-A, Tulsa, Okla.

PRODUCTION FOR SALE

PRODUCTION FOR SALE—40 bbls. daily—three wells—160 acres; 43 bbls. daily—seven wells—480 acres; 35 bbls. daily—four wells—160 acres. Proven locations to drill—four producing horizons. Bill Mashunkashey, Box 365, Pawhuska, Okla.

PRODUCTION WANTED

WANTED: Oil properties 100 to 5,000 barrels daily in Oklahoma and Kansas. Morris Sitrin, P. O. Box 1160, Tulsa, Okla.

AIRCRAFT

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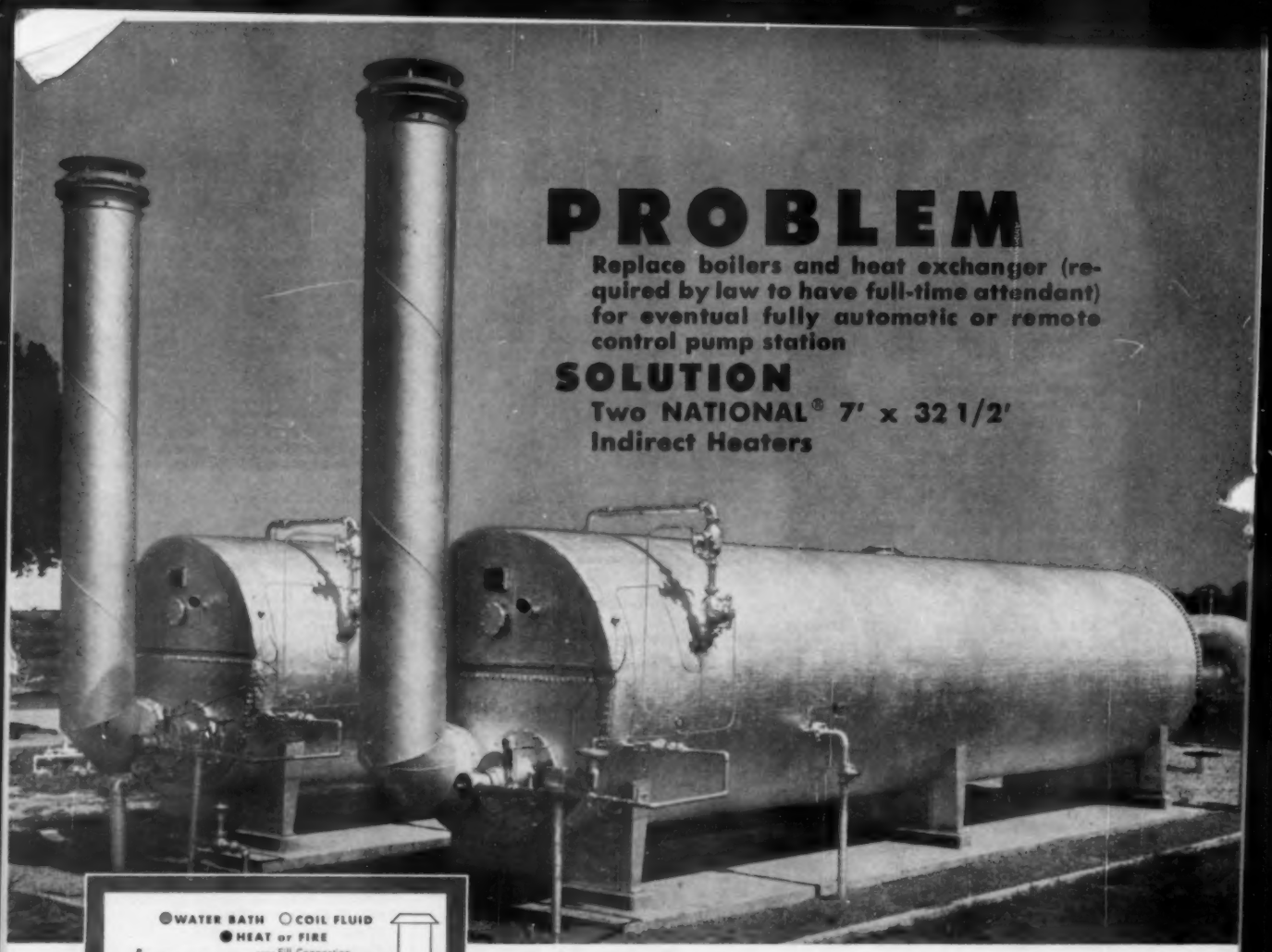
LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that 40.06 acres of land within the known geologic structure of the Carterville field, in Webster Parish, Louisiana, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 1:00 p.m., EST, July 16, 1958, when bids will be opened. Details of the lease offering, description of the land, how and where to submit bids and bid forms may be obtained from the Manager, Eastern States Land Office, Bureau of Land Management, Washington 25. D. C. H. K. Scholl, Manager.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington, D. C. Notice is hereby given that approximately 10.71 acres of land comprising the Natchez National Cemetery in T. 7 N., R. 3 W., Wash., Mer., Adams County, Mississippi, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 1:00 p.m., E.D.T., August 6, 1958, when bids will be opened. Details of the lease offering, how and where to submit bids, may be obtained from the Geological Survey's Oil and Gas Supervisor at 239 Federal Building, Tulsa, Oklahoma or the Conservation Division, General Services Administration Building, Washington 25, D. C., and from the Minerals Staff Office or the Eastern States Land Office, Interior Building, Washington 25, D. C. Edward Woozley, Director.



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Replace boilers and heat exchanger (required by law to have full-time attendant) for eventual fully automatic or remote control pump station

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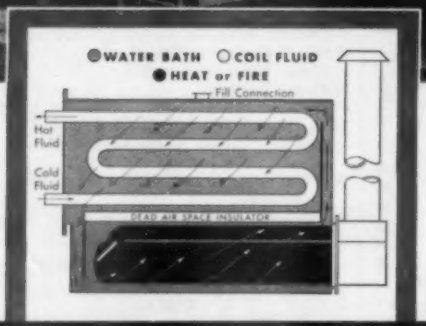

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